5-1-2020

Progression Magazine, 2020 Spring/Summer

Coastal Carolina University

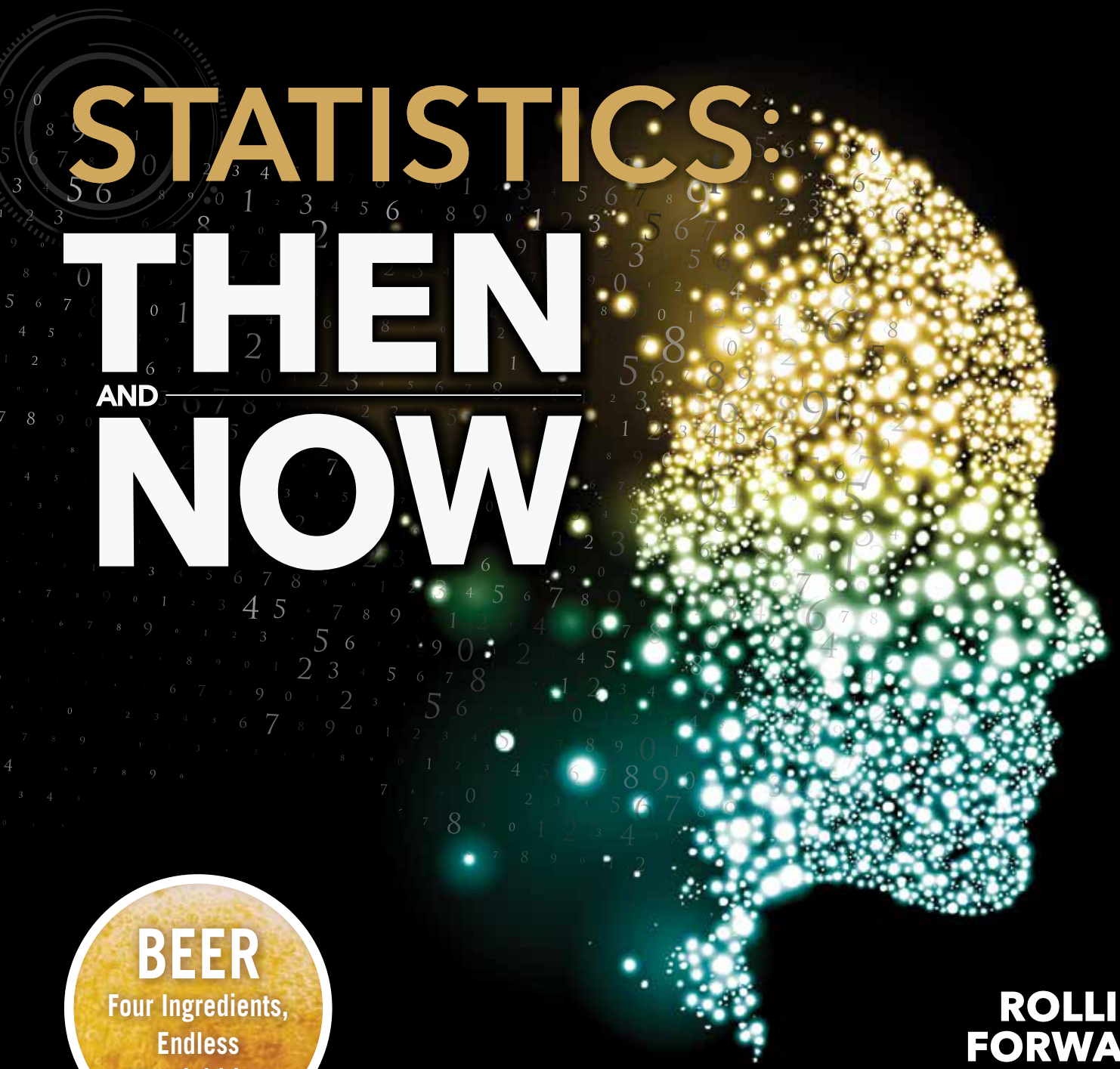
COASTAL CAROLINA UNIVERSITY

progression MAGAZINE

SPRING/SUMMER 2020

KEEPING UP WITH THE EDUCATIONAL MOMENTUM OF THE GUPTA COLLEGE OF SCIENCE

STATISTICS: THEN AND NOW



BEER

Four Ingredients, Endless Possibilities

ROLLING FORWARD

CCU's Bike Program for the Homeless

progression

A message from the dean

We hope you enjoy reading our newest edition of Progression, the magazine of the Gupta College of Science. In this issue, we highlight some of the interesting things going on in our college including faculty and student research.

This has been an extremely busy couple of months as the University planned for online learning for the spring and fall semesters in response to the novel coronavirus. This fall, we are offering an array of learning options for students ranging from face-to-face to fully online courses as we deal with the uncertainty of the ongoing pandemic.

While we will have more information on this topic in our next issue, two Coastal faculty members (Michelle Barthet, Ph.D., and Paul Richardson, Ph.D.) were featured in local news media as they worked to develop and validate a rapid test for the virus. We are extremely proud of their efforts in this important project. I will also note that you, our alumni, played a role in this endeavor as your unrestricted gifts to the Gupta College of Science allowed us to purchase supplies and equipment needed for their work.

Should you want additional information on our programs or any of the articles, please contact me or the specific authors. I can also be followed on Twitter at @CCUScienceDean. To support the work that we do, please contact me directly about how your donation may help.

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ALUMNI INFORMATION
coastal.edu/alumni

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PROGRESSION MAGAZINE
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coastal.edu/science

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progression contents

DEPARTMENT OF BIOLOGY

John Hutchens, Ph.D.
Department Chair

The Department of Biology is home to about 500 undergraduate biology majors, 10 graduate students, 15 full-time faculty, and 10 lecturers. Undergraduate students in our department earn a Bachelor of Science in biology. We also offer other programs of study that prepare students for entry into various health professions. Our department participates in the Master of Science in coastal marine and wetland studies and offers courses for graduate students in education.

Students in our department have access to professors with expertise ranging from molecules to ecosystems. Faculty in the Department of Biology provide excellent opportunities for learning inside the classroom and out. Our faculty have varied research interests, and undergraduates can participate in that research.

Visit coastal.edu/biology.
John Hutchens can be reached at jjhutche@coastal.edu or 843.349.2169.

DEPARTMENT OF KINESIOLOGY

Gregory F. Martel, Ph.D.
Department Chair

The Department of Kinesiology at CCU is a dynamic unit of faculty, staff, and students who study and promote human movement (kinesiology) as applied to a variety of physical activity, sport, and therapeutic settings. The department houses a major in exercise and sport science (EXSS), minors in EXSS and sport coaching, Physically Active Living Skills (PALS) classes, and Community Fitness Testing program. Nationally, regionally, and locally, there has been an increase in demand for kinesiology-related services and programs; this is reflected in the rapid growth of the EXSS major since beginning at Coastal Carolina University in January 2008. The EXSS major is now the third largest on campus. Our role is to provide students with the knowledge, skills, abilities, and attitudes for effective leadership in the field of kinesiology. We excel not only by teaching well, but by engaging students in hands-on research, community service projects, and field-based learning and leadership opportunities.

Visit coastal.edu/knes.
Greg Martel can be reached at gmartel@coastal.edu or 843.349.2957.

DEPARTMENT OF CHEMISTRY

Paul Richardson, Ph.D.
Department Chair

Our department is home to two disciplines within the physical sciences: chemistry and biochemistry. Bachelor of Science degrees are offered in chemistry and biochemistry. Whether you are here for a course in science as part of the Core Curriculum or you are interested in becoming a chemistry or biochemistry major, please contact us with any questions you may have.

Visit coastal.edu/chem.
Paul Richardson can be reached at prichar@coastal.edu or 843.349.2598.

DEPARTMENT OF HEALTH SCIENCES

Fredanna M'Cormack McGough, Ph.D.
Department Chair

The Department of Health Sciences is home to programs that incorporate evidence-based best practices for disease prevention, health assessment, health management, quality care, and patient safety. Through community collaborations and diverse faculty research interests, students can participate in research activities that connect theory to practice. The department offers Bachelor of Science degrees in public health, health administration (completion program), and nursing (2+2 Nursing Residential program and RN-to-BSN completion program). The 2+2 Nursing Residential program is a collaborative between Coastal Carolina University and Horry-Georgetown Technical College (HGTC) and is for first-time freshmen only.

The nursing completion program is committed to advancing the education of registered nurses to meet the local and global growing health care needs. The health administration completion program builds on foundation courses in associate degree and other four-year degree programs. The public health program focuses on the art and science of promoting healthy communities and healthy behaviors.

Visit coastal.edu/healthsciences.
Fredanna M'Cormack McGough can be reached at fmcorma@coastal.edu or 843.349.2991.

DEPARTMENT OF COMPUTING SCIENCES

Jean French, Ph.D.
Department Chair

The Department of Computing Sciences offers three undergraduate degrees, serving roughly 400 actively enrolled majors in computer science, information systems, and information technology. The department offers minors in web application development, scientific computing, and computer science. Both the computer science and information systems major programs are accredited by the Accreditation Board for Engineering and Technology Inc. The department also offers a completely online Master of Science in information systems technology, which has a dual concentration in both security and data analytics. The department supports the University Core Curriculum and other majors and minors of study with course offerings in web development, programming, and business applications.

Visit coastal.edu/computing.
Jean French can be reached at jennis@coastal.edu or 843.234.3430.

DEPARTMENT OF SOCIOLOGY

Robert Jenkot, Ph.D.
Department Chair

This is an exciting time to explore the Department of Sociology. Sociology has a strong history of being student-centered in teaching and research. We offer our students a wide variety of educational opportunities to explore the social world and to take part in changing that world. In order to maintain our student-centered approach to education, all of our professors are active researchers. We bring our experience with various topics into the classroom so that our students get to see what sociology is, how it works, and what it can be used for in the world around them. Importantly, our students are invited to work with our professors on research projects that might interest them. Our students have access to professors who teach courses in: sexuality and gender; race and ethnic relations; social inequality; crime and deviance; religion; popular culture; social justice; health and medicine; sports; HIV/AIDS; juvenile delinquency; and the social relations of the South.

Visit coastal.edu/sociology.
Robert Jenkot can be reached at rjenkot@coastal.edu or 843.349.2274.

DEPARTMENT OF MARINE SCIENCE

Craig Gilman, Ph.D.
Department Chair

The Department of Marine Science offers one of the largest undergraduate marine science programs on the East Coast. In addition to undergraduate studies, the department houses the Coastal Marine and Wetland Studies master's program and the Marine Science: Coastal and Marine Systems Science doctoral program. Lecture, laboratory, and field experiences are integrated to provide students with an outstanding and well-rounded education. With our ideal location near the coast and collection of research-active faculty committed to undergraduate and graduate education, our strength is in providing individual attention and hands-on opportunities.

Visit coastal.edu/marine.
Craig Gilman can be reached at gilman@coastal.edu or 843.349.2228.

DEPARTMENT OF RECREATION AND SPORT MANAGEMENT

Colleen McGlone, Ph.D.
Department Chair

The Department of Recreation and Sport Management currently enrolls more than 300 students as well as houses a graduate program in sport management. Recreation and sport management professionals create, plan, market, implement, and evaluate leisure and recreational activities in both the private and public sectors, as well as in both nonprofit and for-profit industries. In other words, our work is your play. The program works with the Coastal Carolina University Department of Athletics in several capacities and events, training students in specialized ticketing technology and sales techniques.

The faculty have a wide range of experience in the field, which they bring to the classroom to enhance students' abilities to connect theory and practices. In addition, faculty maintain very active research agendas in which students frequently assist.

Visit coastal.edu/rsm.
Colleen McGlone can be reached at cmcglone@coastal.edu or 843.349.2989.

DEPARTMENT OF PSYCHOLOGY

Andrew Terranova, Ph.D.
Department Chair

The Department of Psychology enrolls more than 500 undergraduates. We offer a Bachelor of Science degree and emphasize the scientific nature of psychology and experimental research methods. Our 13 full-time faculty have expertise in a wide variety of areas, including experimental, social, developmental, cognitive, biological, school, and clinical psychology. Our faculty are excellent teachers and active researchers in the field, presenting at conferences, contributing articles and books to the research literature, and sharing their findings and expertise with the media. Through our research methods sequence, students gain extensive knowledge and experience by designing and conducting research. Motivated majors may find additional opportunities to join faculty research labs as research assistants.

Visit coastal.edu/psych.
Andrew Terranova can be reached at terranova@coastal.edu or 843.349.4034.

DEPARTMENT OF MATHEMATICS AND STATISTICS

Thomas Hoffman, Ph.D.
Department Chair

The goal of the Department of Mathematics and Statistics at Coastal Carolina University is to improve students' mathematical understanding and competence. However, we also strive to illustrate the importance of mathematics, both as an interesting and challenging subject on its own, and as a tool that can be applied to other disciplines. Our two degree programs (applied mathematics and statistics) are designed to develop a high degree of mathematical proficiency, as well as extensive reasoning and problem-solving skills. We recognize the interdisciplinary nature of the modern mathematical world. Therefore, students may choose to concentrate their studies in analysis, applied mathematics, discrete mathematics, mathematics for secondary education, or statistics while still obtaining a solid mathematical background.

Visit coastal.edu/math.
Tom Hoffman can can be reached at thoffman@coastal.edu or 843.349.2249.

DEPARTMENT OF PHYSICS AND ENGINEERING SCIENCE

George Hitt, Ph.D.
Department Chair

The Department of Physics and Engineering Science is a group of faculty and staff seeking to promote an atmosphere of scholarly endeavors that emphasizes the application of the scientific method in the generation of knowledge across its major and non-major curricula in a liberal arts context. The faculty are committed to developing strong student competencies in physical and engineering science and its applications in a technology-rich, interactive, student-centered learning environment and to preparing students to successfully compete for employment or to succeed in graduate school. We take pride in our high-quality teaching using current pedagogic techniques, our proactive mentoring and advising, and our outreach to the local community. We strive to be a focal point for disciplinary scholarship and expertise within the college, and to collaborate with our colleagues in the college to actively contribute to the advancement of science. The faculty supports the goals of the University's Core Curriculum through general education courses in physics and astronomy.

Visit coastal.edu/phys.
George Hitt can be reached at ghitt@coastal.edu or 843.349.2066.

STATISTICS:

THEN AND NOW

*by **Lindsey Bell, Ph.D.**, assistant professor, Department of Mathematics and Statistics*

STATISTICS. BIG DATA. DATA SCIENCE.

As our world evolves, so does the language used to describe the progress. We are now wading in an ocean of data like never before. How did we get here? When did we first get our toes wet? What do we do now that we are here? During the inaugural year of our major in applied statistics at Coastal Carolina University, it seems fitting to reflect on the discipline as a whole. Examining lineage can inform us how to proceed in a field that is becoming increasingly significant.

THE DEVELOPMENT OF STATISTICS AS A DISCIPLINE

Statistics is a discipline that carries a fantastic story of metamorphosis. In its infancy, the discipline was born out of a need for information on the state. Census taking is credited as the first form of statistics. As far back as 3800 B.C.E., we see the Babylonian Empire taking count of livestock. The earliest surviving census data are from the Han Dynasty in 2 A.D. Fast forward to 1790, we see the first U.S. Census taken on horseback over an 18-month period. Tabulations of the data were useful for taxation, representation in government, and measures of military might. Such records were called "political arithmetic" in English. In Latin, the phrase was "statisticum collegium," meaning "council of state." The German scientist Gottfried Achenwall introduced the term "statistik" in 1749 meaning "science of the state." From these ancient and narrowly purposed origins, the discipline of statistics began. There was little actual mathematics or science behind the process as we see it today.

In the 1800s, the discipline of statistics entered its first cocoon. Probability was the critical ingredient to facilitate the emergence of a new field. It was Belgian mathematician Adolphe Quetelet who championed the necessity of probability in the political and social arithmetic of the day. The observation of "statistical laws" challenged his thinking. These included observations that French criminal statistics were very similar from year to year, as if a quota of thefts had to be met. The same was observed for birth and death records. A new way of thinking began to take root. Perhaps it was not necessary to understand social behavior at the individual level, for the individual was unpredictable, but the collective was in fact more regular.

Around the same time, similar logic was applied in physics. Scottish physicist James Clerk Maxwell argued that regularities observed in the behavior of a large number of molecules were adequate to establish the thermodynamic laws of gases. Even Max Planck was initially skeptical that regularity prevailed at the macro-level while chaos reigned at the molecular level.

Mathematics being essential in making the connection between small-scale uncertainty and large-scale predictability was already established by Abraham de

THE DEVELOPMENT OF STATISTICS AT COASTAL CAROLINA UNIVERSITY

- **1954** — Coastal Carolina Junior College opened as a branch of the College of Charleston.
- **1960** — USC-Coastal Carolina College became a branch of USC.
- **1975** — USC-Coastal Carolina College awarded its first four-year degree.
- **1980** — School of Mathematics, Computer Science, and Statistics established.
- **1993** — Coastal Carolina University established as an independent, public institution.
- **1993** — Department of Mathematics established.
- **1999** — Statistics minor created.
- **2000** — Department of Mathematics and Statistics established.
- **2019** — Statistics major created.

Deborah Vrooman, Ph.D., here assisting a student, was instrumental in suggesting the change in the name of the Department to Mathematics and Statistics as she thought this was a way to attract faculty to teach in the statistics program.

Moivre (normal distribution) and Adrien-Marie Legendre (method of least squares). In 1809, it was the German mathematician Carl Friedrich Gauss who made the connection that the method of least squares provided a best estimate under the assumption of normally distributed random error. This link established much of the statistical inference used today. It allowed for a flourish of activity in the 1920s and '30s regarding experimental design, hypothesis testing, confidence intervals, and Bayesian inference led by well-known names such as Gosset, Pearson, Fisher, and Jeffreys.

Furthermore, 1850-1900 was labeled the "golden age of statistical graphics." During this time, John Snow made his famous dot map of cholera outbreaks in London, and Florence Nightingale used her coxcomb plot to convey need for improved military field hospitals; the field of statistics finally began to emerge from its cocoon. In 1942, statistician Maurice Kendall claimed that "statisticians have already overrun every branch of science with a rapidity of conquest rivaled only by Attila, Mohammed, and the Colorado beetle." Kendall's sentiments are easy to understand given the interdisciplinary evolution of the subject.

THE HISTORICAL DEVELOPMENT OF STATISTICS TIMELINE

3800 BCE

First known census is conducted by the Babylonian Empire.

1749

The word "statistik" is introduced by German Gottfried Achenwall.

1790

U.S. Census begins.

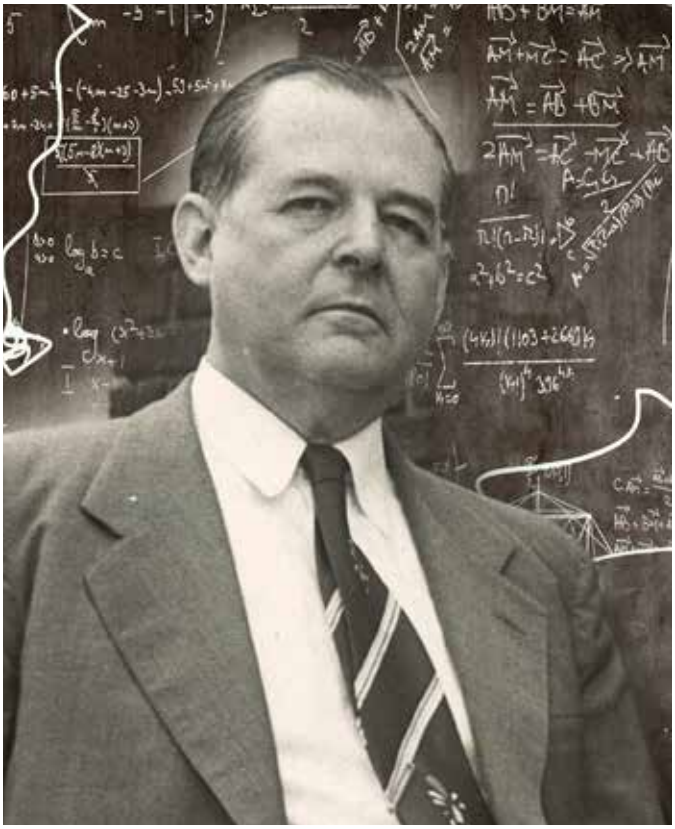
1834

London Statistical Society begins (now the Royal Statistical Society).

THE DEVELOPMENT OF STATISTICS IN UNIVERSITIES

Just as the discipline of statistics underwent a major reconstruction, so too did its place in the university. Harold Hotelling wrote a provocative paper in 1949 that can be considered the catalyst for reconstruction. Statistics developed as an area of study in American higher education after the Great War. Over the next few decades, courses in statistics were taught in a variety of departments with no coordination or communication. Hotelling argued that the selection of teachers was not based on scholarship in statistics, but in the use of statistics in a particular field. He claimed that this method of selection brought "perpetuation of obsolete ideas and unsound methods" and pointed out that "Unfortunately, too many people like to do their statistical work just as they say their prayers — merely substitute in a formula found in a highly respected book written a long time ago." Hotelling reasoned that statistics needed its own department to be able to develop and teach new methods. Lone statisticians housed in other departments were often caught "participating in applied statistics rather than specializing in statistical method and theory." Almost as an afterthought, Hotelling proposed statistics education as a requirement in all liberal arts institutions.

The impact of Hotelling's 1949 paper is undoubtedly visible today. Johns Hopkins Department of Biometry and Vital Statistics (1918) and the University of Pennsylvania Department of Economic and Social Statistics (1931) were the first two departments emphasizing statistics in the U.S.



Mathematical statistician Harold Hotelling.

By 1970, Amstat News listed 99 departments or programs with "statistics" in the title, and there are at least 200 at present. Hotelling's call to include statistics in liberal arts education seems to be have been answered by the present-day university curriculum. In the last 20 years, a great deal of work has been done to develop and promote best practices in statistics education. The emphasis is on statistical reasoning to answer questions about the world around us. In this sense, the discipline has not flown far from its humble beginnings.

1839

American Statistical Society is formed to improve the U.S. Census.

1918

Johns Hopkins Department of Biometry and Vital Statistics is created (first department in a U.S. university with the word "statistics" in the name).

1970

There are 99 departments or programs with "statistics" in the name.

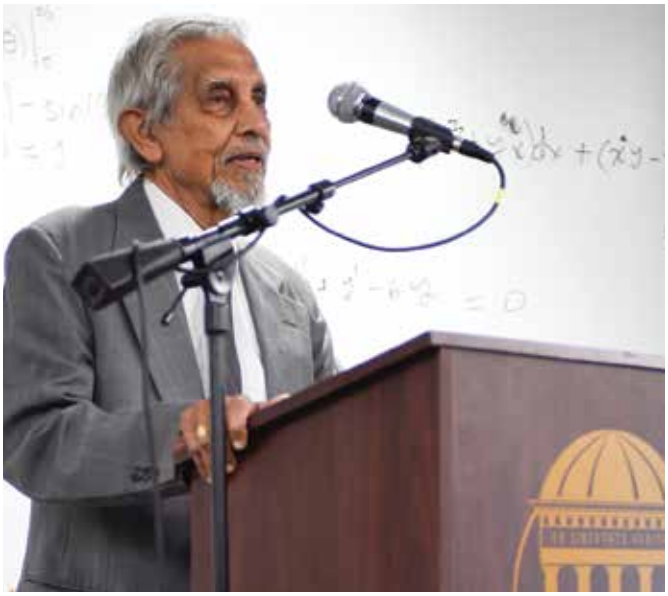
1997

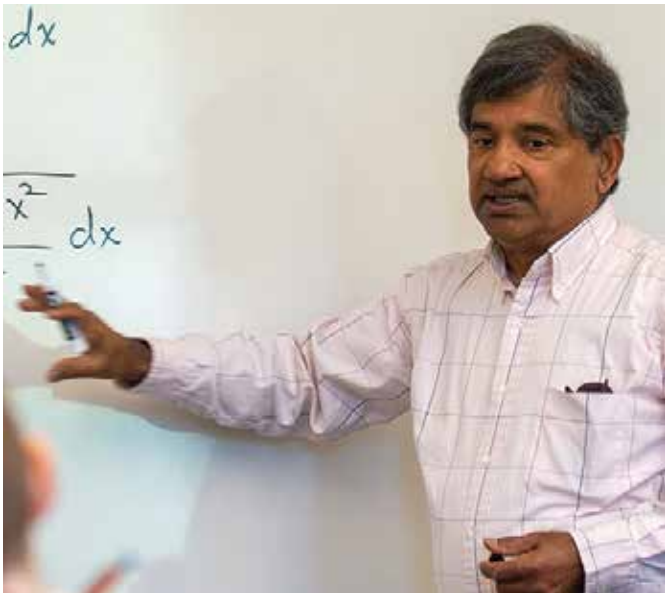
C.F. Jeff WU lectures that statistics be renamed data science.

THE DEVELOPMENT OF STATISTICS AT COASTAL CAROLINA UNIVERSITY

Statistics at Coastal Carolina University has undergone its own period of growth. In 1975, then USC-Coastal Carolina College awarded its first four-year degree. Five years later, in 1980, Coastal Carolina University celebrated its 25th anniversary and established the School of Mathematics, Computer Science, and Statistics. In 1988, the Department of Mathematics was moved into the school of natural and applied sciences while computer science moved into the school of business and computer science. Statistics had no named place in any of the departments at this time. There was an introductory class and three 500-level classes from the University of South Carolina, but nothing that looked like the beginnings of a program in statistics. A few years later in 1993, Coastal Carolina University was founded as an independent public university.

Around this time, a mathematics faculty member, Prashant Sansgiry, attended a 10-day workshop at the University of Tennessee led by Richard L. Scheaffer. Scheaffer was one of the pioneers in activity-based learning for statistics education. Sansgiry took that experience back to Coastal Carolina University in two important ways. First, he created a three-hour laboratory course in introductory statistics. Secondly, he began advocating for the hiring of statisticians in the Department of Mathematics. Around 1998, O.J. Akman was the first statistician hired in the department. Akman was responsible for creating new courses and developed the minor in 1999. A year later, to encourage the growth of the statistics program, the name was changed to the Department





Both Subhash Saxena, Ph.D. (top)*, and Prashant Sansgiry, Ph.D.* (bottom)*, played important roles in developing the math curriculum at CCU.*

2001

William S. Cleveland develops data science as an independent field that includes statistics and modern computational advances.

2013

Statistician Nate Silver claims data scientist is a "sexed-up term for statistician."

2019

More than 200 schools in the U.S. offer a bachelor's degree in statistics.

2020

More than 50 schools in the U.S. offer a bachelor's degree in data science.

> THE TOOLS AND LANGUAGE HAVE CHANGED SINCE THE EARLY 1900S. PERHAPS IT IS TIME FOR THE METHODS WE OFFER AND TEACH TO CHANGE AS WELL.

of Mathematics and Statistics. Between its inception and 2018, 32 students graduated with a minor in statistics. Graduates with the statistics minor found jobs in government, academia, and at companies including Geico, Independent Health, Legal and General, and Vistronix. Due to a tumultuous beginning, it took almost two decades to develop the program even further. Fall 2019 began with the first offering of the major in applied statistics at Coastal Carolina University.

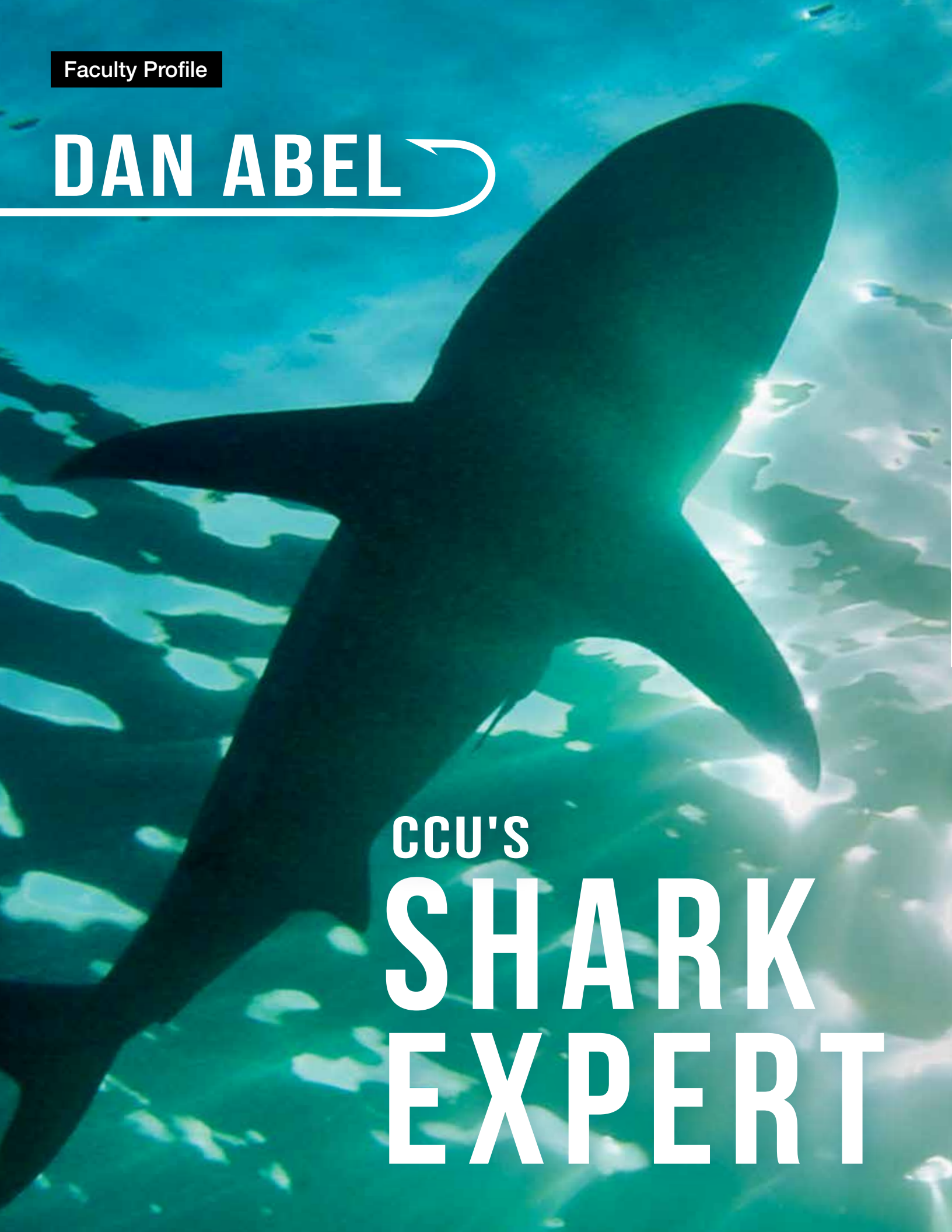
THE CURRENT STATE AND THE FUTURE OF STATISTICS

Until this point, our story has been one of metamorphosis. It has been the story that transformed census taking into a field of study that visualizes and models data to answer questions in any other discipline. Ironically, some statisticians find the current period of growth challenging. After nearly a century of enjoying the advances of the early 1900s, the discipline now finds itself in a second cocoon.

According to George W. Cobb and David S. Moore, "Statistics is a methodological discipline. It exists not for itself but rather to offer to other fields of study a coherent set of ideas and tools for dealing with data." The tools and language have changed since the early 1900s. Perhaps it is time for the methods we offer and teach to change as well. As C.S. Lewis put it, "No living language can be timeless. You might as well ask for a motionless river." Cannot the same be said of all of our disciplines?

Faculty Profile

DAN ABEL



CCU'S SHARK EXPERT

Daniel C. Abel, PhD., is a professor of marine science and the founding director of the Campus and Community Sustainability Initiative. He joined the Coastal Carolina University faculty in 1994. He earned bachelor's and master's degrees from the College of Charleston in 1978 and 1981, respectively, and a Ph.D. in marine biology from Scripps Institution of Oceanography in 1986. He is co-author of the environmental science textbooks,"Environmental Issues in Oceanography" and "Environmental Issues: An Introduction to Sustainability." His research interests include surveys of sting rays and sharks along the Southeast coast.

Q. What courses have you taught at CCU?

A. Undergraduate:

- Introduction to Science (lecture and lab).
- Intro. to Environmental Science (lecture and lab).
- The Sea (lecture and lab).
- Environmental Geology (lecture and lab).
- Intro. to Marine Science (lecture and lab).
- Origin and Evolution of the Marine. Environment (lecture and lab).
- Scientific Communication.
- Honors Service Learning: Habitat for Humanity Green Building Project.
- Marine Biology (lecture and lab).
- Biology of Sharks (lecture and lab, international component).
- Apex Predators and Other Endangered Wildlife (team-taught).
- Marine Physiological Ecology.
- Rescuing Planet Earth.

Graduate:

- Marine Science for Elementary School Teachers (lecture and lab).
- Aquatic Physiological Ecology (lecture).
- Earth System Science for Teachers (lecture and lab).

Q. When did you start the shark program and why?

A. The shark program at CCU was launched in 1997 when I offered my first Biology of Sharks education abroad course at the Bimini Biological Field Station in the Bahamas. I began to focus on sharks as the subject of my scholarship during my four years of graduate school at Scripps Institution of Oceanography in La Jolla, Calif. My dissertation on heart function in sharks combined my two scholarly passions, physiology and ecology, and introduced me to numerous Pacific Coast sharks, including White Sharks, Shortfin Makos, Horn Sharks, Leopard Sharks, Blue Sharks, Smoothhounds, Swell Sharks, and others. It was thus natural for me to continue studying sharks.

What further motivated me to start the program, which expanded in 2001 to include a major research component and transformed into the CCU Shark Project, were the magnificent local ecosystems (particularly Winyah Bay and North Inlet whose shark fauna had been unstudied) and the passion of CCU marine science students to learn about these magnificent beasts. Combine these with threats that humans pose to sharks and their often-unrecognized roles in their ecosystems, and just how cool they are, and I was left with no choice but to start the program.

Dan Abel, professor of marine science at CCU, posing with a Sandbar Shark.

Q. What methods do you use in your research, and where do you do the research?

A. To study sharks, we first must catch them. To do this, we rely on longlining, the same technique used by commercial fishers. Our longlines are about 152 m (500 ft) long and consist of a rope or monofilament mainline to which are attached 25 to 50 gangions, the branches containing the baited hooks. We use a variety of hook sizes, up to the monstrous 18-0 (eighteen-aught) size, to target the entire range of sizes of sharks in local estuarine ecosystems, from 0.3 m (12 in) newborn Atlantic Sharpnose Sharks to > 3-m (9.8 ft) Lemon Sharks. We leave the longlines in the water (we say that we soak them) for about an hour, typically baited with Boston Mackerel, and we catch from zero to as many as 15 sharks per longline. Our long-term average is about two sharks per line. Lately we have been targeting bigger species, like Bull and Lemon Sharks, which we have long felt were under-represented in our surveys. To catch these sharks, we set drum lines, which have a single hook and the biggest monofilament (1,200-lb test) available. In the summer and early fall of 2019, we caught more Bull Sharks in Winyah Bay than in the previous 18 years combined.

One of our research directions is to understand how the sharks we catch select the habitat they occupy, so we collect a variety of data before and after every longline. These data include Secchi depth (an indicator of water clarity), and surface and bottom temperature, salinity, and dissolved oxygen concentration. We

Former CCU graduate student, Jessie Wingar (center) *working on a university research cruise as part of Abel's Biology of Sharks course.*

also note the tidal stage. We measure, tag, take blood other tissue samples, and quickly release the sharks. If the sharks are in good shape, we will take a few minutes to educate students about them, and teach students how to handle a shark.

In addition to longlines, we have employed gill nets and tangle nets and have also used hook-and-line fishing.

Since determining where sharks move is important to understanding their ecology, we tag individuals of most species. Conventional tags that we use include roto-tags, which are similar to livestock ear tags, affixed to the dorsal fin, and stainless steel dart tags anchored in the muscle. These are provided to us by the National Oceanic and Atmospheric Administration (NOAA). We rely on the goodwill of the recreational or commercial fisher who catches the shark to call or email NOAA with the capture location and date, as well as other information, such as the total length of the shark. NOAA subsequently provides recapture data to us. Recapture rates are in the low single digits.

A major weakness of the conventional tagging described above is that at best you get information only between the initial capture and subsequent recapture. For finer resolution of shark movement, we use acoustic (sound wave) telemetry. We use both active and passive acoustic tracking. In both cases, an acoustic tag, that is, a transmitter, is either surgically implanted in the abdomen of the shark or is affixed to the shark's exterior. The tags ping at low intensity at a frequency between 35 and 80 kHz.

For active tracking, we use a hydrophone mounted on the bow of a skiff, and we follow the aural pings while noting the location. In passive tracking, individual sharks are not followed but rather are detected by acoustic receivers that we have placed strategically throughout Winyah Bay. Since our sharks are all migratory and not permanent residents, and since the battery life of acoustic tags is as long as 10 years, we also rely on detections by receivers placed by others at locations along the entire Atlantic and Gulf coasts, which are periodically reported to us. Similarly, we report detections of animals tagged by others to them. Drawbacks to this method include the cost (about $300 per tag and >$1,500 per receiver) and the detection range, which does not typically exceed 400 m (1,300 ft) and varies with environmental factors.

Depending on the project, we also collect and analyze blood samples, and take fin clips for future DNA analysis and tissue plugs for analysis of stable isotope ratios. This last method assumes "you are what you eat" and is useful for understanding a species' diet and trophic (feeding) ecology.

For a project examining shark behavior, we maintained sharks in outdoor pens and used videography. Back in the lab, we have microscopically looked at plastics in sharks and organs like hearts and rectal glands. Finally, we use a variety of statistical approaches and software packages to analyze our data. Methods still on the drawing board include satellite tagging and using drones for aerial surveys.

Our primary research site is Winyah Bay which is a partially mixed estuary whose shark fauna had not been systematically and intensively studied before we initiated the CCU Shark Project. Winyah Bay is one of the most wondrous places on the planet, a gem unknown to most residents of the Grand Strand, and one that is home to >10 species of sharks.

In addition to Winyah Bay, we have also conducted studies in other South Carolina ecosystems, including North Inlet, Murrells Inlet, North Santee, and Port Royal Sound, and as far away as the Florida Keys and Bimini, Bahamas.

We measure, tag, take blood other tissue samples, and quickly release the sharks. If the sharks are in good shape, we will take a few minutes to educate students about them, and teach students how to handle a shark.

Q. What scientific questions are you addressing?

A. The CCU Shark Project began as a small-scale, episodic, estuarine survey with the dual purpose of teaching students about shark research and to understand ecology and physiology of the sharks found in three Northeast South Carolina estuaries. The initial research goals of the project were to: 1) identify sharks inhabiting these systems; 2) describe shark population structure, distribution, and migrations and their environmental influences; 3) determine whether these systems serve as nurseries; and 4) identify human impacts. We have also studied the physiology and ecology of sharks in other areas. Some of our projects conducted by me, my graduate and undergraduate students, and other collaborators, include:

- Survey of the shark fauna in two South Carolina estuaries and the impact of salinity structure.
- Seasonal occurrence, relative abundance, and migratory movements of juvenile Sandbar Sharks, *Carcharhinus plumbeus*, in Winyah Bay, S.C.
- Osmoregulatory adaptations of deep-sea sharks and whether they represent a paradigm shift.
- Osmoregulation and salinity preference in juvenile Sandbar Sharks *(Carcharhinus plumbeus)* in Winyah Bay, S.C.
- Microplastics in the digestive system of the Atlantic Sharpnose Shark *(Rhizoprionodon terraenovae)* in Winyah Bay, S.C.
- Home range, residency, diel movement and tidal patterns of Bull Sharks *(Carcharhinus leucas)* in Winyah Bay, S.C.
- Residency and movement patterns of Blacktip Sharks, *Carcharhinus limbatus*, in the North Santee estuary.
- Demographics and habitat partitioning of the shark fauna of Port Royal Sound, S.C.
- Determining the relative abundance and habitat preference of elasmobranchs in North Inlet estuary, S.C.
- Blacktip shark *Carcharhinus limbatus* presence at fishing piers in S.C.: association and environmental drivers.
- The effects of familiarity on the social interactions of juvenile Lemon Sharks, *Negaprion brevirostris*.
- Analysis of permanent magnets as elasmobranch bycatch reduction devices in hook-and-line and longline trials.
- Response of juvenile Lemon Sharks, *Negaprion brevirostris*, to a magnetic barrier simulating a beach net.
- Responses of the Southern Stingray *(Dasyatis americana)* and the Nurse Shark *(Ginglymostoma cirratum)* to permanent magnets.
- Unique rectal gland morphology and plasma chemistry of the deep-sea shark family Hexanchidae.
- Habitat selection and demographics of Sandbar Sharks in Winyah Bay, S.C.
- Distribution and movements of neonate Atlantic Sharpnose Sharks, *Rhizoprionodon terraenovae*, in a S.C. estuary ocean waters.
- Comparison of the elasmobranch fauna in two South Carolina estuaries differing in the degree of human impact.
- Habitat utilization by multiple coastal shark species in a Southeastern salt marsh nursery system.
- Comparison of the hearts of deep-sea and shallow-water sharks.

Dan Abel doing research at Winyah Bay, Georgetown, S.C., in 2002.

CCU students observing actively-feeding Caribbean Reef Sharks in Bimini, Bahamas.

Q. What are the significant findings of your research?

A. The following is a brief list of some of our more salient findings:

- The number (concentration) of micro-plastics in Atlantic Sharpnose Sharks from Winyah Bay was among the highest found in sharks.
- Juvenile Sandbar Sharks spending their summer and early fall in Winyah Bay migrated south to Florida, a previously undocumented route.
- Juvenile Sandbar Sharks in Winyah Bay exhibited similar osmoregulatory adaptations to those of Bull Sharks (the first time this has been documented).
- The rectal glands of Hexanchid (sixgill) sharks exhibited a unique morphology indicative of their phylogenetic age more so than their deep-sea habitat.
- Extensive longline and gill net surveys of Murrells Inlet revealed a highly depauperate shark fauna, compared to that of North Inlet.
- Winyah Bay and other local estuarine ecosystems represent important habitat and nursery grounds for some shark species.
- Juvenile Lemon Sharks are capable of recognizing each other, and prefer familiars to strangers.
- Salinity strongly influences the distribution of all species of sharks and rays in Winyah Bay.
- Some mature Blacktip Sharks associate with specific piers, likely attracted by increased foraging opportunities afforded by the pier structure, or by attraction from angler discards or bait. This is the first scientific study of the association of sharks with piers.
- Strong permanent magnets repel some species of sharks and may have utility as personal shark deterrents or to decrease shark and ray bycatch in beach nets and commercial longlines.

Q. What directions might the shark program take in the future?

A. The shark program has hidden benefits, and we will continue as long as CCU supports us as it has during the last 25 years. First, we teach students about conducting research on the water. Surprisingly, some marine science majors have graduated with experience from only one or, sometimes, no cruises. I'd like to increase that number to four or five cruises for marine science majors. Second, the shark cruises embody the coastal in Coastal Carolina University. We teach participants about marine environmental issues and sustainability, and help them develop the sense of place that they can never achieve in the classroom. Also, although logistically difficult, wouldn't it be great to take every CCU graduate student, undergraduate student, faculty member, staff member, and administrator on a shark research cruise? An educator's dream, if an administrative nightmare.

Research-wise, we intend to push forward on some of the questions that have not been fully or satisfactorily answered on understanding the ecology of sharks in Winyah Bay and other coastal ecosystems in Northeast South Carolina. Currently, we are looking at the accumulation of micro-plastics starting with neonate (newborn) Atlantic Sharpnose Sharks born locally and documenting how much microplastic they acquire during their six-month or more local residencies. We may also undertake a study of sharks along beaches, research that may strike a nerve locally but which is crying to be conducted.

Finally, Dean Grubbs of Florida State University and I have co-authored, "Shark Biology and Conservation for Enthusiasts, Educators, and Students," to be published by Johns Hopkins Univerity in 2020; and one on Apex Predators, with co-authors Robert Johnson and

We teach participants about marine environmental issues and sustainability, and help them develop the sense of place that they can never achieve in the classroom.

Former CCU graduate students Kelsey Martin (top) *and Carolina Collatos* (bottom) *removing hooks from a large southern stingray* (top) *and a juvenile sandbar shark* (bottom).

Sharon Gillman, behind that. Plus, there are several manuscripts on our research that need to be published. Then, there is the second edition of "Shark Biology and Conservation."

Q. Do you have any suggestions for students wanting to study sharks?

A. (1) Take MSCI 473/473L, Biology of Sharks. The course is offered three different ways (take only one of them).

(A) Take the course in fall semester. There is a maximum of 20 seats in the fall offering. The class meets twice weekly. The lab meets as a traditional lab only two or three times; the remaining lab time is spent on five or more shark research and student training cruises offered at various times.

(B) Attend the Maymester study abroad trip.
Maximum enrollment is 16. The course includes six days at the Bimini Biological Field Station in the Bahamas, followed by field trips during the two weeks following the trip. There is a substantial cost associated with this option. For more information go to coastal.edu/educationabroad/step2researchprograms/faculty-ledprograms/maymesterbiologyofsharksinbimini

(C) Take the *NEW* course in the Summer I term.
Maximum enrollment is 14. The class typically meets M–Th for five weeks in Georgetown. Labs will consist mostly of cruises but will include traditional labs.

(2) Volunteer on our cruises.
Please either see me or email CCU Shark Research at ccusharkresearch@gmail.com to get on our mailing list. Cruises occur at all hours of the day during all days of the week. Most cruises are scheduled for summer and fall, but we episodically sample in the winter. Cruises are not limited to marine science majors; we gladly take any members of the CCU community.

(3) Complete an internship. There are now numerous domestic and international internship opportunities that enable you to work closely with sharks. Either see me or contact Robert Bulsza, director of internships and service learning (Career Services Center, Lib Jackson Student Union A203B).

(4) Complete other courses.
If you are considering working with sharks for a career, one of the best strategies is to become an exceptional scientist focusing not on sharks, but rather specializing in a field in which the principles and skills you learn could be transferred to the study of sharks. These include ecology, taxonomy, physiology, molecular biology, conservation biology, behavior, fisheries, etc.

VIDEO CONTENT

Monica Gray

to direct Coastal Carolina University's Engineering Science program

Monica Gray, Ph.D., M.P.H., C.P.H., P.E., is an associate professor and program director of engineering science at Coastal Carolina University. She simultaneously earned her Ph.D. in civil and environmental engineering (water resources) and M.P.H. (environmental health) from the University of South Florida. She also earned an M.S. in biological engineering from the University of Georgia and a B.S. (hon) in agricultural engineering from the University of the West Indies. A seasoned engineer and educator, she has worked in both private and public industries as well as held both faculty and administrative positions in higher education. Gray has been instrumental in successfully developing and implementing study abroad opportunities for undergraduate engineers while internationalizing the engineering curriculum through cooperation, consortia, and curriculum integration. She has been an ABET program evaluator for the past five years.

Q. What attracted you to the position at CCU?

A. I am very passionate about improving the engineering profession by ensuring the quality of education to our future engineers. This is one of the reasons I am an ABET (Accreditation Board for Engineering and Technology) program evaluator (PEV) tasked with reviewing engineering programs around the country for final accreditation action. From my years in industry and academia, I am convinced that students are better prepared for both the classroom and the job market when they have multiple structured and scaffolded opportunities to learn beyond the four walls. My ultimate goal is to establish an active consulting platform that utilizes undergraduate students, develop co-op/internship programs in partnership with regional firms, and create a streamlined pathway for students to gain professional certifications and licensure. CCU provides me with the opportunity to establish these endeavors from the ground up, which also satisfies the engineer and designer in me.

Q. Can you provide a brief overview of the Engineering Science program?

A. The Engineering Science program trains future leaders who will develop and implement sustainable solutions to global challenges. It does so by employing high-quality teaching and engaged learning, creative research, community outreach, entrepreneurship, and innovation in engineering sciences and design. The Engineering Science program is a four-year curriculum that includes a general education component; foundational mathematics, science, and engineering courses; a two-term minor capstone design experience; and an area of concentration. All areas of concentration include a culminating two-term major capstone design experience. Upon completing all requirements, students are awarded a Bachelor of Science (B.S.) in engineering science with their selected area of concentration.

The vision of the Engineering Science program is to:

- Increase participation of under-represented and minority groups and address the persistent degree attainment gap in engineering.
- Create a learning and professional environment where diversity is celebrated as seminal to program success and where all students, particularly underrepresented and minority groups, thrive and excel.
- Develop future leaders who are knowledgeable and are able to apply scientific and engineering principles to impact the well-being of the global society and its environment.

Q. What are your immediate plans for the Engineering Science program?

A. The most immediate goal is to earn accreditation status from ABET. We are hard at work preparing our self-study,

> Engineering is an awesome and noble profession, not simply a job. This means that we, like members of other professions, such as doctors and lawyers, are entrusted with the public's health and safety.
>
> – *Monica Gray, Ph.D.*

as well as getting ready for our accreditation visit around mid-October. ABET will announce final accreditation action for our program in August 2021, but it will be effective August 2018, so both our 2018-2019 and 2019-2020 graduates will be considered to have graduated from an ABET-accredited program.

Q. What are your long-term plans for the Engineering Science program?

A. The program is growing rapidly and gaining tremendous traction in the community. Gaining our accreditation will solidify our value to industries in our community and beyond. We hope to create a student-centered learning environment based on an experiential educational model that is globally recognized for accessibility, inclusion, and diversity. For example, our new curriculum requires all students to complete at least one three-credit hour internship (at least 150 work hours). Further, by the time of graduation, all our students will have participated in at least 600 hours of design, engineering, and/or professional enhancement activities. Towards this end, we are strengthening our relationships with our graduate and technical institutional partners, expanding our public/private partnerships with industries, and developing international curricular infrastructure and global initiatives. Finally, we are building out new concentrations to provide more options for our students as well as to add value to their experience and degree.

Q. Do you have advice or suggestions for students thinking about engineering science as a major?

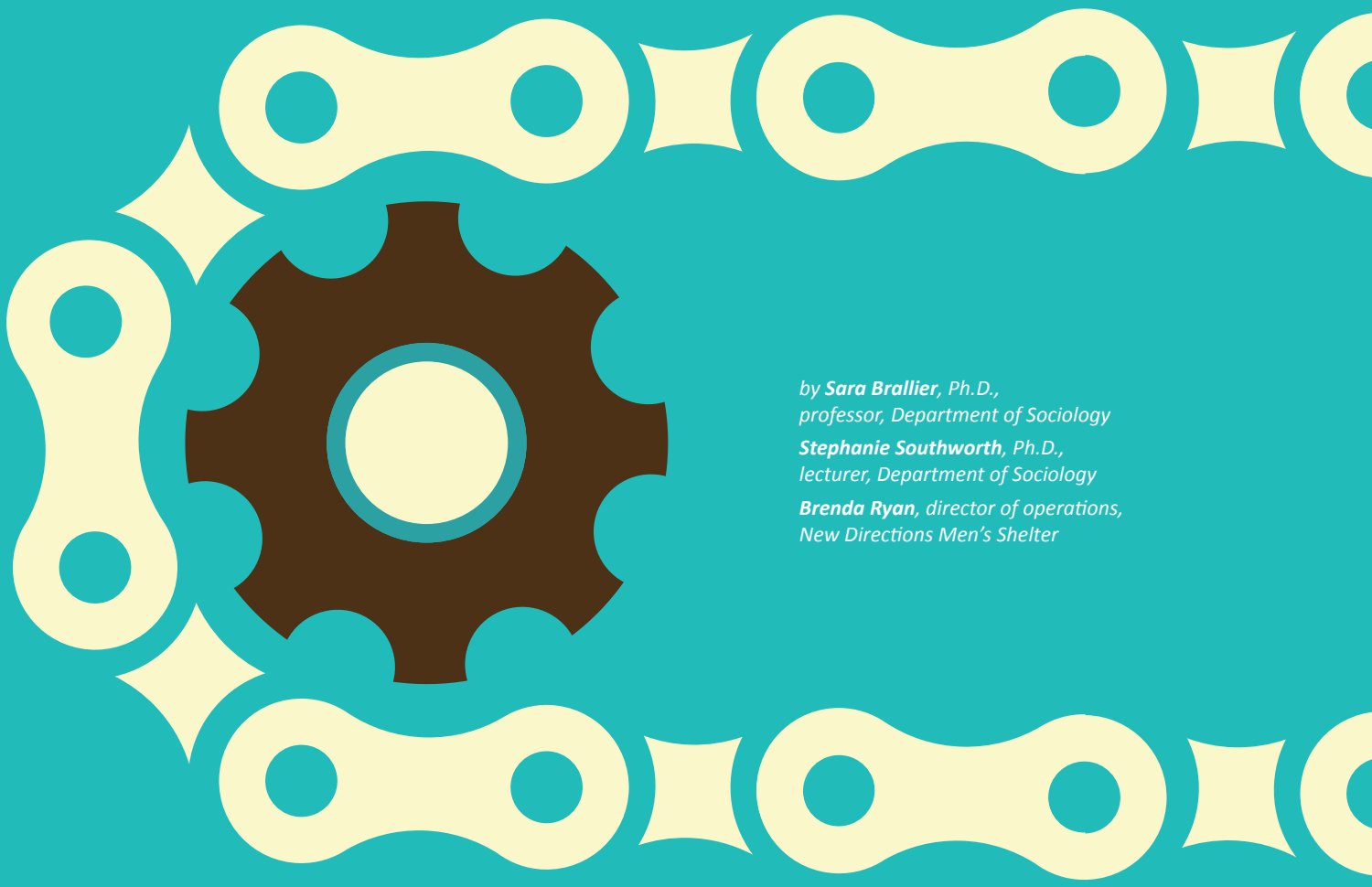
A. Engineering is an awesome and noble profession, not simply a job. This means that we, like members of other professions, such as doctors and lawyers, are entrusted with the public's health and safety. What makes engineering unique is, upon graduating from the undergraduate degree, one immediately enters the profession. Other professions require graduate studies before being able to become licensed to practice; engineering does not. Within four years of graduating, an engineer can earn licensure and be registered in his or her state as a professional engineer or P.E. With this in mind, I encourage students who are considering engineering as a major to indeed load up on all the mathematics they can take and handle. If they are in high school, take math classes over the summers at a local community college. However, more importantly, keep in mind that engineering is truly about design and that requires patience, not giving up, repeating a process until you get your result, and great work ethic.

Professor Monica Gray assists engineering science major Victoria Singleton.

Q. Other thoughts about the program?

A. At Coastal Carolina University, we believe that a student enters our engineering program as an engineer, and he/she becomes better at each level. It is a self-actualizing process as opposed to continually proving of oneself. In early coursework, students learn about being an engineer while in upper-level classes and are introduced to the tools and skills for becoming a better engineer. This is one of the reasons we created the mathless minor in engineering. While we do not want to lose students, if a student changes major, they do not have to leave our program empty-handed.

Rolling FORWARD



by ***Sara Brallier,*** *Ph.D.,*
professor, Department of Sociology
Stephanie Southworth, *Ph.D.,*
lecturer, Department of Sociology
Brenda Ryan, *director of operations,*
New Directions Men's Shelter

Starting as an experimental project in 2017, the Rolling Forward program continues to assist in eliminating the barrier of reliable and cheap transportation that many of Horry County's homeless face in their attempt for a normal life.

Many sociologists hope their students come to understand the complex and multi-faceted nature of social problems as well as the experiences of marginalized populations. One marginalized population that is often stereotyped and misunderstood is the homeless. On any given day, approximately 700 people are experiencing homelessness in Horry County.

To meet our educational goals and better serve the local homeless community, we designed an experiential learning project in partnership with New Directions Men's Shelter. This project has been incorporated into nine upper-level sociology courses at Coastal Carolina University since 2016. Students in Social Inequality and Sociology of Poverty courses visit the men's shelter, volunteer their time, and ask shelter residents to participate in interviews focusing on the resources the homeless individuals believed would enable them to secure permanent housing.

Results of the initial interviews conducted in 2017 indicated that shelter residents, for the most part, were able to meet many of their basic needs such as securing food, clothing, a place to bathe, and a place to wash their clothes as well as obtaining physical and mental care. However, they perceived a lack of reliable and affordable transportation as a significant barrier to obtaining and maintaining employment, making and keeping health care and social service appointments, and maintaining their social support network.

Using this information, we decided to host a student-operated fundraiser to raise funds needed to provide this transportation for shelter residents. We also coordinated with the CCU Department of Public Safety and arranged for bikes abandoned by students at the end of the academic year to be donated to the homeless shelter. Additionally, we applied

> Getting involved with the Rolling Forward program opened my eyes about homelessness and showed me that literally anyone could become homeless. I think this course should be a requirement for students at CCU. It will make students appreciate what they have a lot more."
>
> *–Courtney Brown '19*

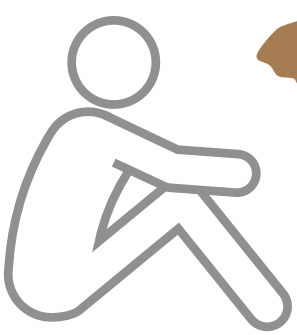
for internal grant funding from Coastal Carolina University. With the combination of the donated bikes, bike racks purchased with internal grants funding, and a fundraiser, the Rolling Forward program officially began in July 2018. Since then, more than 300 residents have borrowed a bike. The bikes were borrowed to go to work (40 percent); to go to the store, to the beach, or to run other errands (32 percent); to look for work (9 percent); to visit family, to go to church, or to visit other social service agencies (13 percent); and to look for housing (6 percent).

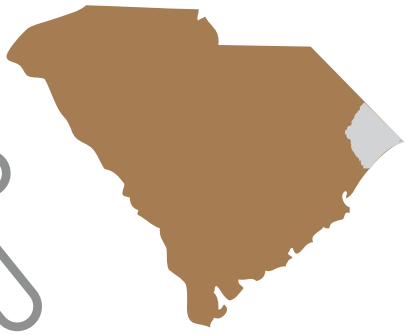
The bike share program has been an amazing opportunity for students to see public sociology in action. Sociologists often highlight social inequalities, but many times, their material comes from books and articles written by others. The experiences we gained at the shelter and by working with the homeless population and service providers informed what we taught and allowed students to have current, real-life information about the community where they live.

Students have continued to participate in the Rolling Forward program through experiential coursework and internships. Because of participation in the experiential learning project, students come to a deeper understanding of the societal factors that contribute to homelessness and poverty, and develop a greater understanding of, and empathy for, this disadvantaged population. In addition, many students in these courses report that their work with homeless individuals was a life-changing experience. "This class was so informative. Getting involved with the Rolling Forward program opened my eyes about homelessness and showed me that literally anyone could become homeless," said Courtney Brown '19, a former sociology student. "I think this course should be a requirement for students at CCU. It will make students appreciate what they have a lot more."

ON ANY GIVEN DAY, APPROXIMATELY

700





PEOPLE ARE EXPERIENCING HOMELESSNESS IN HORRY COUNTY, S.C.

Photo courtesy of Jayne Smith and Shutter Up Photography.

CCU faculty and students displaying their new Rolling Forward T-shirts.

Bike maintenance by CCU students is an important facet of Rolling Forward.

Since the Rolling Forward program began in July 2018, more than 300 residents have borrowed a bike.

BIKES USED TO GO TO WORK	40%
BIKES USED TO GO TO THE STORE, BEACH, RUN OTHER ERRANDS	32%
BIKES USED TO VISIT CHURCH, FAMILY, AND SOCIAL SERVICES	13%
BIKES USED TO LOOK FOR WORK	9%
BIKES USED TO LOOK FOR HOUSING	6%

Photo courtesy of Jayne Smith and Shutter Up Photography.

(Left to right) *Brenda Ryan, Sarah Brallier, Ph.D., and Elizabeth Schlueter standing with a bike used in Rolling Forward.*

Students often enter their sociology classes with stereotypes of the homeless as lazy and drug-addicted, often viewing individuals experiencing homelessness as somehow "other" or different from "regular" people. Although addiction is often associated with homelessness, students in the experiential learning courses begin to understand the ways in which addiction, inadequate education, inadequate health care, unaffordable housing, and low-wage work intersect and lead to a loss of housing.

Working in the shelters and interviewing shelter clients humanizes the homeless. Students begin to see the shelter residents as individuals who society's social structure has failed, and begin to advocate for their rights. They talk to individuals working in low-wage, seasonal jobs, or receiving disability benefits or social security, and start to realize that these sources of money are not enough to afford rent and other necessities. They realize that "getting a job" will not necessarily lift people out of poverty. Students see overworked caseworkers doing all they can do for their clients while turning people away because there are not enough beds. By enrolling in these courses, students become more compassionate, more understanding, and have fewer stereotypes of the homeless than they did before taking the course. In addition, they gain

Photo courtesy of Jayne Smith and Shutter Up Photography.

Brenda Ryan from New Directions holding cupcakes at the first anniversary of Rolling Forward.

CCU students and staff preparing bikes for Rolling Forward.

valuable social capital with local caseworkers and have valuable experience they can add to their resumes.

The Rolling Forward program has continued to grow through support from the University, the community, and New Directions. The administration of New Directions appreciates the steady stream of student volunteers and interns as well the research collaboration with CCU faculty. The program has given their clients a valuable tool, helping them to meet their personal goals, and get to interviews, jobs, doctor appointments, and more. The program has been so successful that in March 2020, New Directions used community donations to expand the Rolling Forward program into their women's shelter.

To learn about how you can help individuals experiencing homelessness get to where they need to go, visit the Rolling Forward Facebook page at facebook.com/rollingforward.

Comments from CCU students who participated in the project:

"People who are not informed about the homeless automatically assume the reason they are homeless is that they are on drugs or use their rent money on other items. Not having affordable housing, no jobs in range, subprime loans, and globalization are all structural reasons for someone to be homeless with affordable housing being the main one."

"This experience was one of the most vital in my life. We live in a world where our perspective is the only perspective there is. This class changed that. I now see in the eyes of those that go through this system."

"I personally believe every student should have to take this class. This class was very rewarding especially going to the women's/men's shelter for community service and just being able to talk to the people there. This class has given me a different perspective on homelessness/poverty and has made me look at my life and become more appreciative of the little things in life."

Comments from shelter residents using the Rolling Forward bikes:

"I've been in the shelter for a week and have used a bike every day. Awesome program. Thank you for looking out for people like us."

"I am very appreciative to have the bike program in operation in New Directions. It has really helped me get from point A (shelter) to point B and back. I was stranded after Hurricane Florence and the bikes came in handy. I think the bike program is very effective and necessary and I am thankful."

"I use a bike every day two or three times a day to look for work. The bike program is a blessing. Could not have made it without it. It is useful because I like to help other people."

SCAN
TO WATCH ADDITIONAL VIDEO ON THE ROLLING FORWARD PROGRAM.

FOUR INGREDIENTS, ENDLESS POSSIBILITIES

by Drew Budner, Ph.D.,
assistant professor,
Department of Chemistry

ON A SURFACE LEVEL, BEER CAN BE SIMPLE.

It is made by combining together four basic ingredients: water, grain (mainly malted barley), yeast, and hops. However, from these simple ingredients there are more than 75 different styles recognized by the U.S. Brewers Association. The different styles are created by manipulating just one or two of these simple ingredients. The flavor of the finished beer is affected by the interaction of each of these ingredients.

For example, there are two major classes of beer styles: ales and lagers. The difference between these two different styles is based on the strain of yeast used, and if they are more productive in warmer or colder fermentation conditions. From there, beer can be manipulated by how much hops are added. Hops are a very interesting type of plant and contribute to beer flavor by adding bitterness and the distinct hop aroma.

IPAs, for example, have a greater amount of hops added especially later in the brewing process to produce the distinct hop flavor and aroma characteristic of this style. Brewing water can also have an impact on the final beer produced. The difference in flavor between a Czech pilsner and an America pilsner, for example, is due to the water used during the brewing process.

Lastly, the grains, typically malted barley, have a greater impact on the final beer flavor and aroma. The amount of grain roasting changes the flavor of the final product from light and mild, to dark and roasted with a strong bread-like flavor.

HOPS

BARLEY

WATER

YEAST

Senior chemistry major Samantha Tucker and biology major Tyra Counties (left to right) *examine the chemistry of a fermentation solution.*

The process of making beer is fairly modest, as it can be broken down into four easy steps:

- Grain malting.
- Mashing.
- Boiling.
- Fermenting.

During malting, grain is partially germinated and then roasted. This process converts some of the grain's starch to simple fermentable sugars. The grains are then roasted to stop the germination and to further develop the flavor. The degree of roasting can change the grain from light, which will produce a mild beer, to a dark roast, which results in a darker, richer beer flavor. During the roasting process, the grain undergoes a series of chemical changes known as the Millard reactions, the same type of reactions that occur during the browning of bread and the roasting of coffee beans.

In the next step of the brewing process, mashing, water is added to the roasted grain to remove the simple sugars to produce a sweet complex mixture known as wort. This liquid will provide food for the yeast during fermentation, and much of the complexity of the finished beer originates from wort. The combination of warm water and crushed grains allows for the water to extract sugars, proteins, and a wide range of other compounds out of the grain. In addition, the warm water allows for enzymatic activity to restart, which further promotes the conversion of grain starch to simpler sugars and adds complexity to the wort. The water is then drained off, and the crushed grains act as a filter so the wort removed will contain little particulate matter.

This wort is then brought to a boil to stop the enzymatic activity and sterilize the wort. This sterilization kills all unwanted yeast and bacteria which may be present in this warm, sugary solution. In addition, the boiling of the wort allows for extracted protein to combine and come out of solution and settle to the bottom of the kettle. With sufficient time for the wort to sterilize and proteins to coagulate, usually 60 to 90 minutes, the wort is cooled and a single strain of yeast is added or pitched. Oxygen is traditionally added and the fermenter is closed to the surrounding atmosphere so fermentation is allowed to occur. The fermentation process can take anywhere from a few days to a couple of weeks depending on the yeast strain used and the target style.

As you can imagine, the final beer flavor and aroma are affected by all of the ingredients and the process these ingredients undergo. Each beer style is unique and distinctly different. With this great diversity of taste, it is possible for everyone to find a style of beer to love. While the perception of the different beer styles is a very personal thing, the chemical make-up of these beers is fairly consistent, but is not currently well understood.

We know that there are more than 800 compounds found in beers in a wide range of concentrations. A goal of my research group is to help close the gap between the

understanding of flavor and the underlying chemistry of the beer. The focus of my group's work is investigating the chemicals that are present within beers brewed using grains other than malted barley. For example, there is interest in using grains that do not contain gluten (e.g., sorghum, millet, and buckwheat). With the current influx of gluten-free products in the market, understanding the flavor and aroma impact of gluten-free grains used in brewing is critical.

To date, I have worked with a large number of Coastal Carolina University undergraduates who have brewed a series of beers using sorghum as the grain source. While others have investigated the use of sorghum as a brewing grain, there are no other groups that I am aware of that are investigating the impact on flavor and aroma. We have discovered a few things about our lab-brewed beers. For example, sorghum beers have a much yellower color compared to traditional beers.

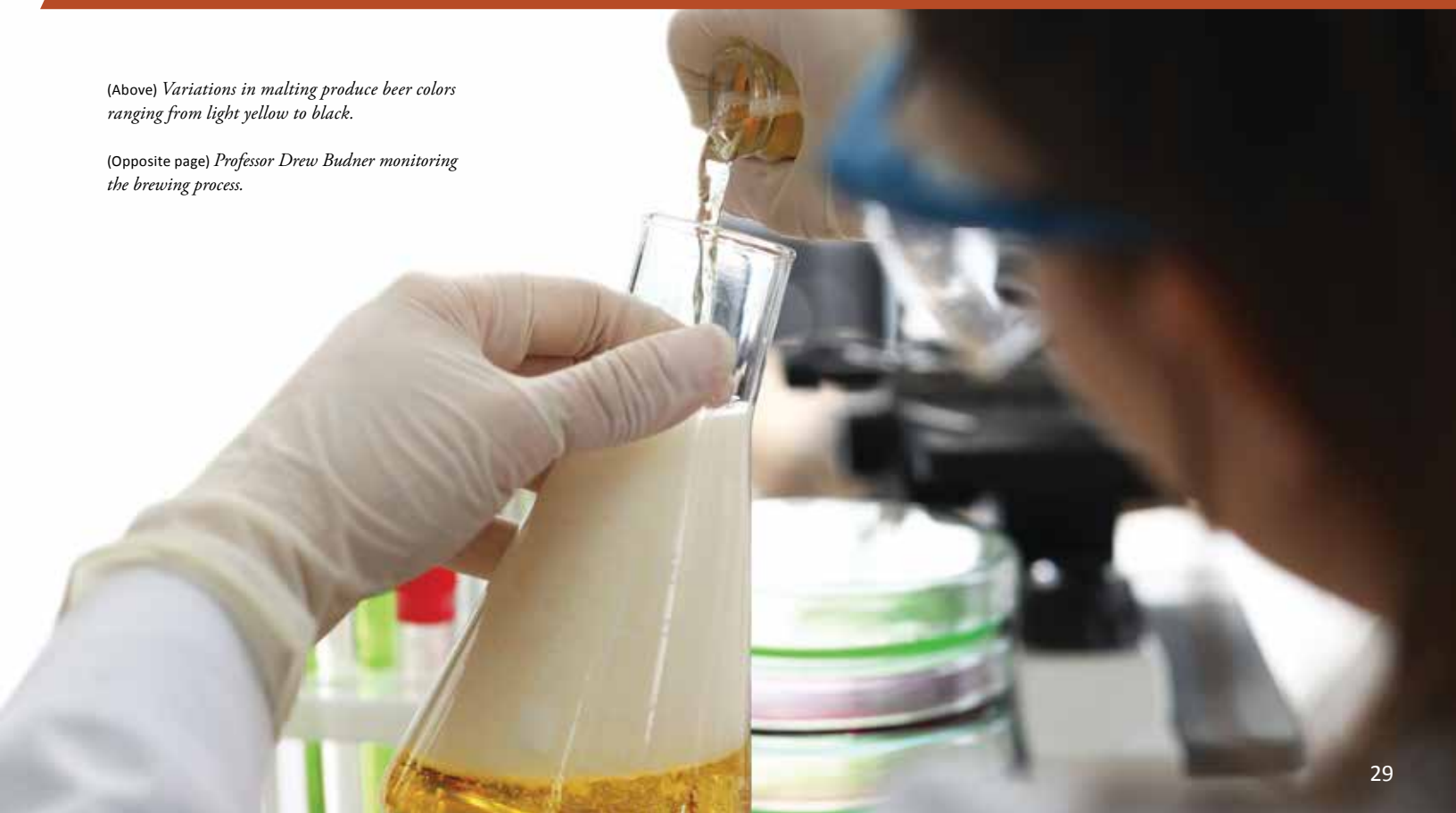
We focused on the aroma of the beer first because it is simpler to determine chemical composition using a method called solid phase microextraction followed by gas chromatography with mass spectral detection. This allows us to determine a wide range of chemicals over a wide range of concentrations. Using this method, we found when comparing sorghum to barley beer, that there is not a set of compounds in the aroma that is unique to either barley or sorghum, but there are about 40 compounds that are present in both beer types but in statistically different amounts. We can also change the proportion of these key compounds by using different yeast strains.

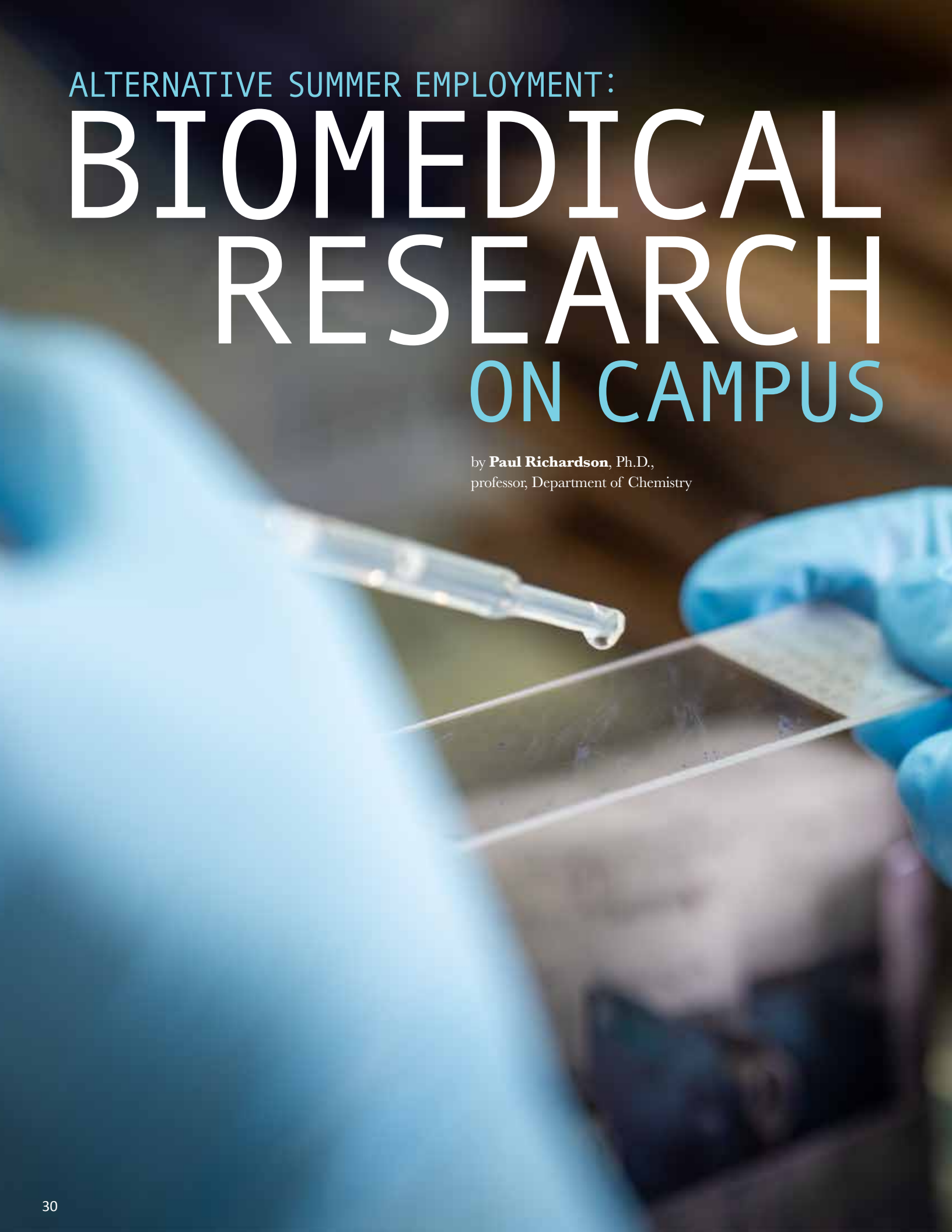
We also developed a method to determine the fermentable sugars that are present using a derivatization followed by high performance liquid chromatography. Our methods and experience allowed me to develop a collaboration with the Fermentation Science Institute at Southern Illinois University.

We hope to expand our work by looking at millet, buckwheat, quinoa, and other types of fermented beverages such as mead (honey-based beer). Our work in the analysis of gluten-free grains will provide valuable information for the brewing community when developing new beers for people with gluten intolerance. This will increase the potential for everyone to find a great-tasting beer to enjoy on a hot summer day.

(Above) *Variations in malting produce beer colors ranging from light yellow to black.*

(Opposite page) *Professor Drew Budner monitoring the brewing process.*

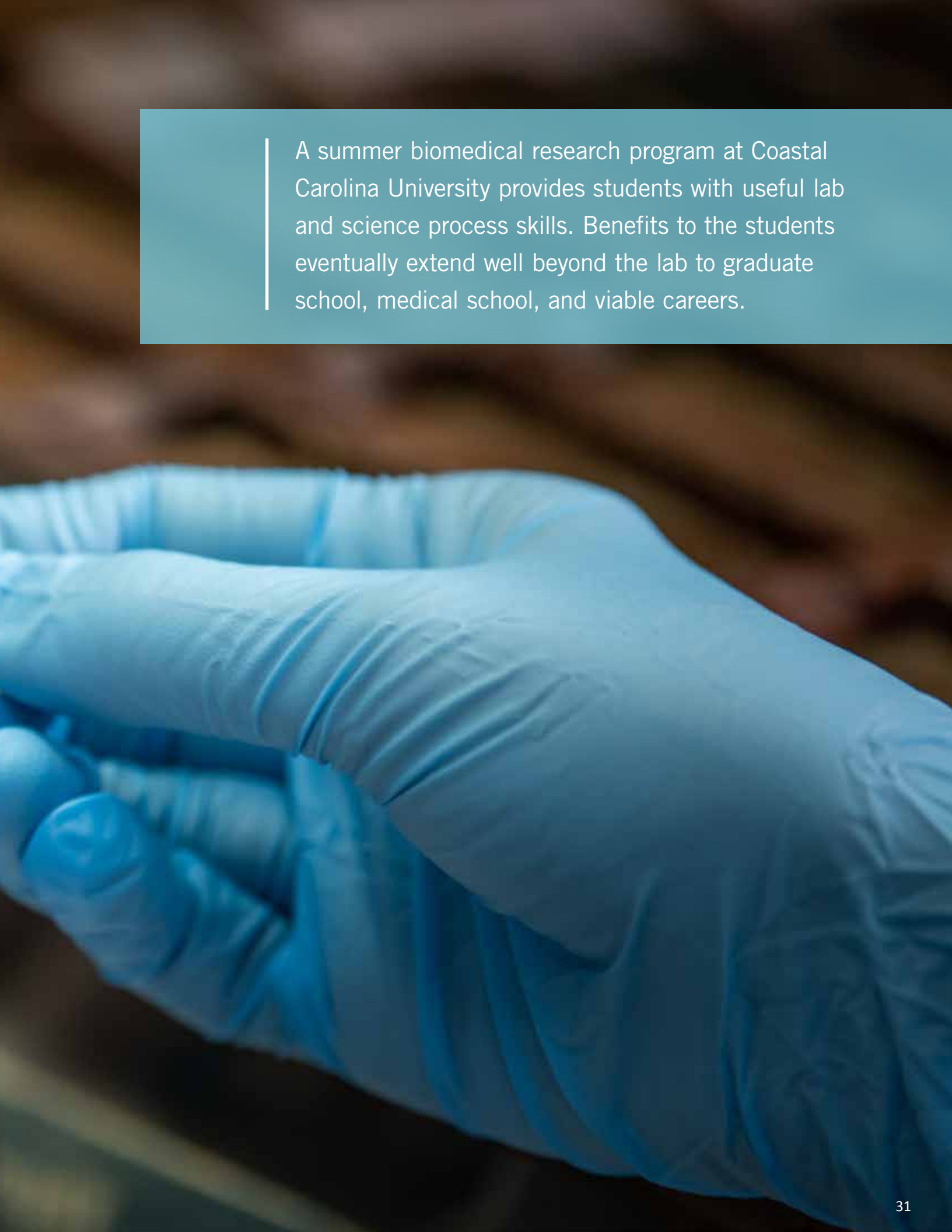




ALTERNATIVE SUMMER EMPLOYMENT:

BIOMEDICAL RESEARCH ON CAMPUS

by **Paul Richardson**, Ph.D.,
professor, Department of Chemistry



A summer biomedical research program at Coastal Carolina University provides students with useful lab and science process skills. Benefits to the students eventually extend well beyond the lab to graduate school, medical school, and viable careers.

Coastal Carolina University SCoRE students (left to right) *Jonah Nordeen, Dustin Lowe, Samantha Tucker, Ryan Covington, and Kori Swanson.*

For many of our students, when summer comes, they head out and look for employment to earn some money. With Myrtle Beach being such a large tourist destination, there are many jobs for waiters, hostesses, lifeguards, and greeters. However, there are those who look for an alternative summer job. These students seek summer employment that not only raises money for their college endeavors, but also provides valuable experiences to help further their careers in the biomedical field. Coastal Carolina University faculty, realizing that students need experience in biomedical sciences while they earn a paycheck, decided to do something about it. They developed an opportunity to help our students become trained in the rigors of biomedical research.

In 2015, faculty from three departments formed a collaborative and submitted a grant to join the South Carolina Idea Network of Biomedical Excellence online at sites.google.com/view/scinbre/home. The purpose of this program was to increase biomedical research on campus, provide opportunities for undergraduate research, and create a pipeline to biomedical careers. After the application was accepted, the faculty members joined a research collective of 13 institutions within the state of South Carolina. This collective allowed the sharing of technical resources and expertise to help further the purpose of the program. Together, this group applied for and received a grant for more than $25 million funded by the National Institutes of Health and National Institute of General Medical Sciences. Each member used a portion of the grant to help set up a summer research program.

During Summer 2016, Coastal Carolina University launched the Summer Coastal Research Experience (SCoRE). The program was established with four CCU INBRE faculty who served as mentors for undergraduate research. The mentors were selected after the winter break and announced on the CCU INBRE website at ccuinbre.wordpress.com. After they were announced, students (undergraduate and high school) were encouraged to apply. Each student was paid $400 a week for their work (10 weeks for undergraduates and nine weeks for high school students).

Each mentor selected up to two students to work on a research project, one high school student and one undergraduate student. Each student completed an application and met with the faculty mentor for a research interview. The idea of this was to emulate a real-world experience of applying for a position and having an interview. After spring break, the selected research assistants were contacted and invited to join the program. This program model continues using this format.

The SCoRE program is a nine-to-10-weeklong intensive research program with students working 37.5 hours a week on the research project they select. The backbone of this program is the individual attention provided from the research adviser. Each student is trained in the latest biomedical techniques, similar to the skills obtained in a first-year graduate school training. While learning these techniques, students also take part in weekly professional development seminars. The purpose of these seminars is to prepare students for applying to and getting accepted by professional schools after college. The students also learn how to make a scientific poster and present these posters at scientific conferences.

Ultimately, the students present their research at the summer undergraduate research symposium sponsored by the SCoRE program. Following this conference, every student who takes part in the SCoRE program travels to the University of South Carolina School of Medicine to present their research at the state INBRE conference. More than 350 people attend this yearly two-day event with poster sessions, oral talks, and professional development sessions.

When the summer program is completed, many students continue to do research with their faculty mentor during the academic year. They typically sign up for independent research to add to their college transcripts. Many continue to present their research at regional and national conferences.

To pursue the goal of training more students in the biomedical sciences, a new type of course was recently developed titled the Coastal Biomedical Research Activity Seminar (CoBRAS). This is a seminar series where research scientists, medical doctors, graduate school admissions personnel, and former students talk to current students about career choices and life after college. Normally, four to six speakers are scheduled to present each semester.

During the four years of this program, more than 50 students have participated in SCoRE and hundreds have attended the CoBRAS sessions. Many of the undergraduate students who have participated in these programs went on to medical school, graduate school, and research laboratories. Students have also published numerous peer-reviewed articles from these research experiences. Such experiences are clearly valuable as students develop the skills needed to apply to graduate and medical schools and earn a summer living at the same time.

The next time you happen to be on campus during the summer months, head over to the science buildings and observe the research students at work. There is a good chance these students will be the future scientists that cure and treat human disease.

Paul Richardson, Ph.D. (left), *explains a biochemical pathway to SCoRE students* (left to right) *Dustin Lowe, Chase Cortese, Kori Swanson, Samantha Tucker, and Ginny Knight-Liberman.*

SCoRE students Jonah Nordeen and Samantha Tucker conducting biomedical research.

Q&A WITH JOSH LONG

Josh Long is a graduate student in the Department of Marine Science. He answers some questions about his path to CCU and conducting research.

Q. What is your educational and employment background?

A. I've taken a bit of an unconventional path. Following high school and a few years of college, I spent time working as a carpenter, while knowing that I eventually wanted to complete my education. After discovering geology, I returned to school and earned a B.S. degree in geology from the University of Maryland and an M.S. degree in geology from Northern Arizona University (NAU). After graduating from NAU, I began working for an energy company, spending the next eight years working as a geologist in Texas, Colorado, Wyoming, and Alaska.

Q. How did you end up at CCU for graduate study?

A. Although my wife and I both had good careers, I wanted to devote more of my time to research and that meant taking the risk of leaving behind a regular salary and returning to school for my Ph.D. I had a pretty good idea of the type of research I wanted to pursue so it was a question of finding the right combination of school and research faculty. The support of the department and the University played a key role in my decision to come to CCU. The School of the Coastal Environment and the Department of Marine Science are well-equipped, and the faculty have the diverse backgrounds necessary to support graduate studies in this multi-disciplinary program. My advisor, Till J.J. Hanebuth, Ph.D., is well-established within the marine and Quaternary geology field, and his support has been instrumental to my success thus far. Additionally, there is a real opportunity to contribute to my field of study by focusing on the central coast of South Carolina.

Q. What is the focus of your research?

A. My research focuses on the Quaternary evolution of the coastal plain and continental shelf of central and southern South Carolina, with particular emphasis on the Santee River delta, the only river-fed delta along the East Coast of the United States. Essentially, we use the geologic record preserved in the subsurface of the modern coastal plain and continental shelf to reconstruct how these environments have changed over the past 2 million years. These changes are largely driven by changes in sea level controlled by periods of glacial growth and decay, which occur at a periodicity of roughly 100,000 years and include periods during which sea level was as much as 120 meters lower than it is today.

Another aspect of our research focuses on the stratigraphic architecture (i.e., how sediments are arranged) of ancient river channels and valleys along the Atlantic coast from northern-most South Carolina down to southern Georgia.

Josh Long recording sediment characteristics.

The composition and organization of the sediments within these channels provide high-resolution records of the conditions under which they were deposited.

A third and final component of our research focuses on the more recent, late Holocene (last ~7,000 years) record, including the rich human history of the region. Anthropogenic changes made to many of the coastal plain rivers in the Southeast U.S. have had a major impact on the ecology and geology since the early parts of the 18th century. Some of these changes have altered the natural behavior of rivers, marshes, and coastlines in ways that leave imprints in the geological record and will doubtlessly continue to exert significant influence on these sensitive systems in the future.

Q. Has your research yielded any new or novel findings?

A. Our research has been able to document the occurrence of preserved coastal deposits that record the migration of coastal environments across the continental shelf in response to falling sea level during several periods throughout the Pleistocene (12,000 to 2 million years). These have not been reported from other locations along the Atlantic margin and have implications for interpreting not only the timing and magnitude of sea level changes, but the physical processes that were active at the time of deposition.

Additionally, we have been able to document and interpret several important characteristics related to the valley of the Santee River. In particular, we have proposed a link between local fault activity and a major adjustment in the path of the Santee River at some point around 200,000 years ago. We can follow this

paleo-Santee from the point where it diverges from its modern course out onto the continental shelf based in part on some of our newly acquired geophysical data.

Finally, working closely with the South Carolina Geological Survey (SCGS) and U.S. Bureau of Ocean Energy Management (BOEM), we have made significant scientific contributions to a collaborative effort to understand the framework geology offshore of South Carolina, North Carolina, and Georgia.

In addition, we have helped cultivate a strong working relationship between CCU, the SCGS, BOEM, and several other regional schools.

Q. What are your plans post-CCU?

A. My plan is to complete my degree this coming spring and begin a Mendenhall Post-Doctoral Research Fellowship that I have been offered with the United States Geological Survey in Reston, Va. The focus for this position is not all that different from that of my dissertation research: using the geologic record to understand long-term, natural history. The project entails studying the distribution of sediments deposited in ancient coastal plains, rivers, and deltas during the Cretaceous Period (~90-120 million years ago) as preserved in rocks exposed within the Brooks Range of northern Alaska. I'm quite excited about the opportunity, and my experiences at Coastal Carolina University will doubtlessly serve me well.

Q. Do you have any words of wisdom for others considering graduate school?

A. As cliché as it may sound, follow your passions. Sometimes the path you choose isn't easy, but that passion will get you through.

Martin Luther King Jr. (MLK) Teach-Ins enriched by CCU student presentations

Student presentations, titled "An Examination of Inequities and Injustice" were featured during MLK Teach-Ins on Tuesday, Jan. 21, in Johnson Auditorium.

Public health administration major Jedediah Smith addressed rural access to health care providers. Public health major Mia Antonnini '20 discussed health services for the LBGTQ community. Public health major Ava Samkavitz '21 presented research on access to safe water in Flint, Mich. Meredith Byrd '20 explained her research on Appalachian teen pregnancy.

The event complemented the students' PUBH 440 course, which explores the roots of health disparities among marginalized populations.

The event was sponsored by the Office of Intercultural and Inclusion Student Services.

(left to right) *Jedediah Smith, Mia Antonini, Ava Samkavitz, and* (missing) *Meredith Byrd.*

FACULTY RESEARCH PROJECTS

Derek Crane, Ph.D., (Department of Biology) received a grant for $83,855 from the South Carolina Department of Natural Resources. His project, titled "Recruitment and growth of juvenile Atlantic and shortnose sturgeons in the Waccamaw/Pee Dee River system," seeks to address questions related to the recruitment and growth of Atlantic and Shortnose sturgeons that currently limit our understanding of their population ecology and conservation.

The professor also received a $40,449 grant from the South Carolina Department of Natural Resources. His project, titled "Identification of environmental and biological factors limiting occurrence of the sandhills chub in South Carolina," seeks to assess Sandhills Chub populations in South Carolina; identify environmental and biological features associated with healthy populations and depleted or extirpated populations; and develop a predictive model to guide Sandhills Chub conservation and restoration.

In addition, he received a grant for $139,203 from the Virginia Department of Game and Inland Fisheries-U.S. Fish and Wildlife Service. His project, titled "Quantifying catch-and-release mortality and determining its effect on southern muskellunge," seeks to conduct a collaborative effort involving agency biologists, universities, and anglers to quantify catch-and-release mortality of muskellunge in the southern portion of their distribution.

Paul Gayes, Ph.D., (Burroughs & Chapin Center for Marine and Wetland Studies) received grants for a total of $71,614 from the city of North Myrtle Beach and Horry County. His project, titled "Punctuated beach processes management: tracking periodic beach nourishment and episodic storm impacts along the Grand Strand," will provide long-beach profile surveys of the North Myrtle Beach oceanfront, Surfside Beach, and Garden City to document the long-term behavior of beach nourishment projects.

Monica Gray, Ph.D., (Department of Physics and Engineering Science) and **Jennifer Mokos**, Ph.D., (HTC Honors College and Center for Interdisciplinary Studies) received a grant for $10,000 from the SC EPSCoR Scientific Advocate Network (SAN) program. Their project, titled "Broadening participation in engineering: a research experience for high school students and teachers approach," seeks to leverage an ongoing engineering design and community-based research program on campus that will provide focused engineering training for high school teachers interacting with highly diverse and underserved populations and their students.

Christopher Hill, Ph.D., (Department of Biology) received a grant for $23,025 from the South Carolina Department of Natural Resources. His project, titled "Population dynamics of a declining songbird: survivorship and movements in a population of Loggerhead Shrikes (Lanius ludovicianus) in Horry County, South Carolina," seeks to contribute data to rangewide estimates of population parameters of loggerhead shrikes.

William Jones, Ph.D., (Department of Computing Sciences) received a grant for $468,944 from Los Alamos National Security, LLC-U.S. Department of Energy. His project, titled "HPC scheduler resilience research," seeks to identify existing supercomputer/cluster simulators that can either be used directly or, more likely, with significant modification, to study the behavior of LANL HPC systems in the presence of faults and errors, specifically node outages that cause application crashes and result in application rollback, loss of application efficiency, and increased overall time to solution.

Patrick Limber, Ph.D., (Department of Marine Science) received a grant for $195,000 from the United States Geological Survey. His project, titled "Modeling of sea cliff retreat," seeks to make model projections of cliff retreat for the northern coast of California, between San Francisco and the Oregon border.

Varavut Limpasuvan, Ph.D., (Department of Coastal and Marine Systems Science) received a grant of $209,801 from the National Science Foundation. His project, titled "Intergovernmental personnel act (IPA) assignment," provides funding for him to serve for one year at the National Science Foundation as program director for the climate and large-scale dynamics program in the Division of Atmospheric and Geospace Sciences, Directorate for Geosciences.

Robert Young, Ph.D., (College of Graduate Studies and Research) received a grant for $97,125 from the National Oceanic and Atmospheric Administration. His project, titled "The South Carolina Marine Mammal Stranding Network: stranding response and enhanced diagnostic testing," seeks to provide stranding response capacity for the South Carolina Marine Mammal Stranding Network and enhance the ability to perform diagnostic tests on tissues collected from dead stranded marine mammals.

CCU FACULTY AND STUDENT PUBLICATIONS

Alencar, M., **K. Johnson**, V. Gray, R. Mullur, E. Gutierrez and P. Dionico. 2019. "Telehealth-based health coaching increases M-Health device adherence and rate of weight loss in obese participants." Telemedicine and e-Health. 17 April 2019. https://doi.org/10.1089/tmj.2019.0017 (Department of Kinesiology)

Aguirre, K. 2019. "All sorts of people: the beginning of vaccination in America." NSF National Center for Case Study Teaching in Science. (Department of Biology)

Baker, K. and **T.F. Pettijohn II**. 2019. "The effect of physical or psychological pep rallies on introductory psychology test scores." In S. Baker (Ed.) Teaching Tips: A Compendium of Conference Presentations on Teaching, 2017-18. (Department of Psychology)

Brallier, S., S. Southworth and B. Ryan. 2019. "Rolling forward: addressing the needs of the homeless community." Journal of Distress and the Homeless. 28:96-105. (Department of Sociology)

Donaldson, T.N., K.T. Jennings, L.A. Cherep, P.A. Blankenship, **R.M. Yoder**, A.A. Blackwell and D.G. Wallace 2019. "Progression and stop organization reveals conservation of movement organization during dark exploration across rats and mice." Behavioural Processes. 162:29-38. (Department of Psychology)

Guth, L.M., M.P. Rogowski, **J.P. Guilkey** and A.D. Mahon. 2019. "Carbohydrate consumption and variable-intensity exercise responses in boys and men."

European Journal of Applied Physiology. 119:1019-1027. https://doi:10.1007/s00421-019-04091-z. (Department of Kinesiology)

Hannides, A., N. Elko and K. Humiston. 2019. "An ASBPA white paper: the state of understanding of the effects of beach nourishment activities on coastal biogeochemical processes and conditions." Shore & Beach. 87:46-57. https://doi: 10.34237/1008734 (Department of Marine Science)

Hills, W.E. 2019. "Behavioral health and new models of service delivery for an aging world: public/private partnerships to develop best practices of care for older adults." Medical Science Pulse. 13:29-33. https//doi:10.5604/01.3001.0013.1372 (Department of Psychology)

Hills, W.E. and K.T. Hills. 2019. "Virtual treatments in an integrated primary care-behavioral health practice: an overview of synchronous telehealth services to address rural-urban disparities in mental health care." Medical Science Pulse. 13 (September 2020). https://doi:10.5604/01.3001.0013.5239. [Epub ahead of print] (Department of Psychology)

Lambert W.B, **M.J. Stanek**[1], **R. Gurka**, and **E.E. Hackett**. 2019. "Leading-edge vortices over swept-back wings with varying sweep geometries." Royal Society Open Science. 6: https://doi.org/10.1098/rsos.190514 (Department of Coastal and Marine Systems Science)

Larsen, M.E[1]., **D.C. Abel**, **D.P. Crane**, **S.L. Parker**, P.H. Harvey, B.A. Keller and D.R. Grubbs. 2019. "Unique osmoregulatory morphology in primitive sharks: an intermediate state between holocephalan and derived shark secretory morphology." Journal of Fish Biology. 95:1331–1341. https://doi.org/10.1111/jfb.14139 (Departments of Coastal Marine and Systems Science, Marine Science, and Biology)

Lauver J.D., T.E. Cayot, T.R. Rotarius and B.W. Scheuermann. 2019. "Acute neuromuscular and microvascular responses to concentric and eccentric exercise with blood flow restriction." Journal of Strength and Conditioning Research. September 12. https://doi:10.1519/JSC.0000000000003372. (Department of Kinesiology)

Lazarus, E.D., **P.W. Limber**, E.B. Goldstein, R. Dodd and S.B. Armstrong. 2018. "Building back bigger in hurricane strike zones." Nature Sustainability. 12:759. (Department of Marine Science)

Luken, J.O. 2020. "Abandoning risky agriculture and leveraging natural capital: a county-level method for identifying conservation opportunity." Natural Areas Journal. 40:45-50. https://doi.org/10.3375/043.040.0106 (Gupta College of Science)

Matsko[1], I.J. and **E.E. Hackett**. 2019. "Impact of radar data sampling on the accuracy of atmospheric refractivity inversions over marine surfaces." Radio Science. 54. https://doi.org/10.1029/2018RS006757 (Department of Coastal and Marine Systems Science)

Moran, A., M. Culver, **J. Guilkey**, T. Rotarius and **J.D. Lauver**. 2019. "Physiological responses to intermittent endurance exercise with blood flow restriction in the moderate intensity domain." Medicine and Science in Sports & Exercise. 51(5S):464-465. https://doi:10.1249/01.mss.0000561895.68399.45 (Department of Kinesiology)

Munoz, S.E., L. Giosan, M.D. Therell J.W.F. Remo, **Z. Shen**, R.M. Sullivan, C. Wiman, M. O'Donnell and J.P. Donnelly. 2018. "Climatic control of Mississippi River flood hazard amplified by river engineering:" Nature. 556:95-98. https://doi:10.1038/nature26145 (Department of Marine Science)

Pastore, D.M[1]., **R.N. Peterson**, **D.B. Fribance**, **R.Viso** and **E.E. Hackett**. 2019. "Hydrodynamic drivers of dissolved oxygen variability within a tidal creek in Myrtle Beach, South Carolina." Water. 11:1723. https://doi.org/10.3390/w11081723 (Departments of Coastal Marine and Systems Science, and Marine Science)

Saldamarco, C.N. and **T.F. Pettijohn II**. 2019. "Evaluating time delay and exposure to songs with prosocial lyrics and their effects on prosocial behavior." North American Journal of Psychology. 21:843-852. (Department of Psychology)

Smith J.C., B.R. Washell, M.F. Aini, S. Brown and M.C. Hall. 2019. "Effects of static stretching and foam rolling on ankle dorsiflexion range of motion." Medicine and Science in Sports & Exercise. 51:1752-1758 https://doi: 10.1249/MSS.0000000000001964. (Department of Kinesiology)

Stanton, T. and **T.F. Pettijohn II**. 2019. "Relationships among classroom design, instructor characteristics, and student performance." In S. Baker (Ed.) Teaching Tips: A Compendium of Conference Presentations on Teaching, 2017-18. (Department of Psychology)

Sufrinko, A., **J. McAllister-Deitrick**, R.J. Elbin, M.W. Collins and A.P. Kontos. 2018. "Family history of migraine is associated with post-traumatic migraine symptoms following sport-related concussion." Journal of Head Trauma Rehabilitation. 33:7-14. https://doi.10.1097/HTR.0000000000000315 (Department of Kinesiology)

Thompson, J., M. Wolfe, M. Culver, K.E. Johnson and **J.P. Guilkey**. 2019. "Exercise intensity, energy expenditure and enjoyment during variable high intensity exercise in healthy adults." Medicine & Science in Sports & Exercise. 51:327. https://10.1249/01.mss.0000561489.35384.2a (Department of Kinesiology)

Wallace, J., T. Covassin, R. Moran and **J. McAllister-Deitrick**. 2018. "Factors contributing to differences in baseline neurocognitive performance and concussion symptom scores between black and white collegiate athletes." Journal of Racial and Ethnic Health Disparities. 5:894-900. https://doi:10.1007/s40615-017-0437-y. (Department of Kinesiology)

–CCU authors in **bold**.
–CCU student [1].

PRESIDENT'S HONOR LIST

(Students recognized from Fall 2019.)

BIOCHEMISTRY

Sarah Davis
(dual degree in marine science)
James Heldmann
Klea Hoxha
Carson Mickey
Korinne Swanson
Anna Tingler
Kimberly Weaver

BIOLOGY

Brittany Adams
Endry Brito
Killian Bucci
Tamara Butler
Kayla Calderon
Andres Castillo
(dual degree in chemistry)
Hailey Chaisson
Katelyn Cilino
Chase Cortese
Katelyn Covert
Natalie Cyterski
Liam Danaher
(dual degree in biology)
Elmer Diaz Ramirez
Travia Franklin
Nicole Frantz
Cody Glover
Jacqueline Gould
Rebecca Hight
Amy Kahler
Griffin Keys
Mackenzie Kim
Robert Kotara
Tia Mack
Jared Miller
Yousuf Mohammad
Abbey Montoya
Jordan Mozingo
Syeira New
Lindsay Newton
Kaitlin Beasley-Polko
(dual degree in marine science)
Alexis Porohnavi
Sydney Quartucci
Kyra Ricci
Savannah Simpson
Trevor Stevens
Olivia Sundman
Gregory Thompson

CHEMISTRY

Andres Castillo
(dual degree in biology)
Emma Keiner
Antonio Vegas

COMPUTER SCIENCE

Gavin Bailey
Ryan De la Cruz
Kyler Febbroriello
Auston Hefling
Migeljan Imeri
Feng Jiang
Zhuowei Li
Nathan Marshall
Devin McClure
Joseph Prendergast
Zhichen Ren
Benjamin Sheets
Madison Townsend
Joshua Westerhaus
Westley Wooddell
Shangxuan Xie
Zhiyong Yang

ENGINEERING SCIENCE

Gage Campbell
Julianna Davis
Nathan Dempski
Isabella Pinkas
Jaquon Williams

EXERCISE AND SPORT SCIENCE

Hannah Arnold
Kendi Bailey
James Bookard
Krista Brutosky
Emily Calderon
Jordan Cantey
Joy Carlson
Gianna Cataloni
Claire Chapman
Sophia Codair
Alexis Coleman
Lisa D'Ambrosio
Hannah Dresner
Lauren Fedorchak
Gabrielle Freeman
Erik Gabriel
Courtney Grimes
Hannah Hayes
Kiera Heslam
Kylee Hill
Janie Javier
Ahykeem Jennings
Silas Kelly
(dual degree in management)
Marcelo Lage
Janelle Lauttenbach
Gabrielle Leach
Paige Lentz
Whitney Lesaine
Alea Luther
Kaden Marinovich
Dylan Moore
Megan O'Shea
Matthew Panzica
Jordan Pearson
Jordan Pressley
Paige Rivas
Sean Safko
Joseph Sanchez
Evan Sheffer
Kasper Skraep
Kaitlyn Snopek
Tyler Steele
Jennifer Sundahl
(dual degree in marine science)
Brian Sutton
Nicole Tassielli
Emma Thompson
Jenna Thompson
Kendale Utter
Kathryn Wilbanks
Ting Yen Yeh
Alicja Zduniak
Riley Zirpel

HEALTH ADMINISTRATION

Jessica Matthews

INFORMATION SYSTEMS

Mason Beattie
(dual degree in languages and intercultural studies)
Connor Denny-Lybbert
Caleb Fins
Michael Link
Sean Morahan

INFORMATION TECHNOLOGY

William Brown
Jeanne Dehetre
Thomas Fry
Michael Herbst
Dustin Kuczynski
Riley O'Brien
Dawson Pickford
Tyrek Robinson
Yusef Sadek
Colton Simms
Kiera Tyree

MARINE SCIENCE

Alyssa Antolak
Kaitlin Beasley-Polko
(dual degree in biology)
Abigail Beaty
Jacob Berrocal
Alden Bittrick
Trevor Bowser
Matthew Brown
Kristyn Bryant
Cori Carlston
Lauren Carroll
Justin Cerv
Ryan Chinn
Jacqueline Cole
Liam Danaher
(dual degree in biology)
Sarah Davis
(dual degree in biochemistry)
Annamaria Deitz
Cailey Dorman

Gupta College of Science

Brooke Dunnery
Andrew Einhorn
Andrew Elgin
Jason Engler
Kelsey Foster
Gabriella Fritz
Adriene Funck
Hannah Garthwaite
Hazel Gillette
Jonathan Groff
Hannah Haefner
Kaylecia Humphreys
Faith Jacobus
Julie Kavjian
Madeleine Kee
Katherine Kline
Valerie Knowles
Danielle La Venuta
Ezekiel Meyers
Rachel Myers
Amanda Neudenberger
Madison O'Neill
Briar Ownby-Connolly
Riley Phelps
Genevieve Pietrzak
Katherine Prandi
Mackenzie Reese
Ethan Sandy
Lea Schroeder
Margaret Shoop
(dual degree in languages and intercultural studies)
Margaret Smith
Abigail Solarz
Jennifer Sundahl
(dual degree in exercise and sport sciences)
Elizabeth Tautges
Abbey Thomas
Sarah Thomas
Jacob Vannoy
Carleigh Veeley
Ryan Ware
Keela Wells
Karsen Wendelin
Thomas Wesselhoff
Sarah Wessinger
Brittany Whitcher
Makenna Williams
Taylor Wood

MATHEMATICS

Catherine Calabro
Adam Goga
(dual degree in physics)
Sarah Gower
Alessandro Molinas

NURSING

Ryan Williams

PHYSICS

Duvall Dickerson-Evans
Adam Goga
(dual degree in mathematics)
Scott Kobos
Emma Kurth
Grant Mitchell

PSYCHOLOGY

Erin Berzonski
Quinton Bessant
Kaila Billingsley
Nikki Boon
Anna Carpenter
Nora Cheraghi
Kieran Colahan
Sierra Dube
Amy Eacho
Savannah Elliott
Makhiya Eure
Jordan Farrell
Caitlin Ferrari
Reagan Grossoehme
Charlize Johnson
Madison Johnson
Natalie Kellam
Elizabeth Knight
Makenzie Martin
Kelli McElveen
Lyndsey McLamb
Nicole Michael
McKayla Mills
Jenna Mize
Cody Moore
Courtney Moss
Jessie Mount
Caroline Murray
Madison Myers
Alexis Natali
Emma Oswald
Adonya Pertell
Paige Petrizzo
Kayla Powers
Brett Richardson
Callie Rogers
(dual degree in sociology)
Maya Roller
Gabrielle Sellers
Haley Smith
Kaylee Smith
Maria Sparacino
Kallie Stephens
Jaquoia Williams
Jada Wilson
Jarrod Worley

PUBLIC HEALTH

Sarah Allen
Ashton Baker
Raven Brooks
Haylea Collura
Heather De la Cruz
Courtney Dean
Caroline Durham
Stephanie Edge
Destiny Epps
Tynekqua Jackson
Grace Kerr
Zoe Lewis
Catherine McFadden
Michael Meagher
Nicole Pascarella
Lina Perugini
Maria Platis
Erica Richardson
Baylee Ruth
Rebecca Silva
Rachael Smith
Armani Sumpter
Taylor Sweigart
Meghan Thomas

RECREATION AND SPORT MANAGEMENT

Jonathan Banks
Megan Bozzi
David Butler
Victoria Carnevale
William Dillon
Courtney Dornheim
Robert Floyd
Sara Hake
Matthew Hopeck
Gregory Horrocks
Andrew Howard
Connor Kirkley
Brenna Lindner
Kelsey Luther
Kyle McNeice
Carlton Miller
Lou Norton
Kirsten Pecotte
Brian Port
Brenden Reeverts
Jamison Walker
Joshua Wegrzyn
Caroline Weiss
James Will
Brook Willenborg
Nicholas Wilson
Bradley Young

SOCIOLOGY

Sydney Alvis
Emily Aspinall
Robert Fluharty
Tori McLaughlin
Callie Rogers
(dual degree in psychology)
Laine Rushton
Hubertina Searcy
Nicholas Shain
Gregory Stephens
Casey Sullivan

DEAN'S HONOR LIST

(Students recognized from Fall 2019.)

BIOCHEMISTRY

Emily Andrews
Elody Bensch
Quinn Blankenship
Grace Boykin
Kinokia Brown
Ryan Covington
Lissett Diaz
Ashlynn Dorroh
Nicolette Fleck
Nichole Forstell
Hayden Greene
Tavion Griffin
Daimauri Hanna
Candace Howard
Mahealani Kanekoa
Jonah Nordeen
(dual degree in psychology)
Madaline Plank
Victoria Robinson
Mya Roblee
Olivia Shirley
Owen Smith
Tyriek Thompson
Lucy Valentik
Lisha Van Onselen

BIOLOGY

Madison Ackerly
Madison Ahrens
Carlee Andrews
Catherine Austin
Meagan Auth
Gianna Barone
Nicholas Bautz
Antanique Bellinger
Karla Blake
Victoria Blaut
Kylie Bostick
(dual degree in marine science)
Theresa Brick
Deriyah Butler
Lady Cabral
Barijana Caldas
Lauren Carpenter
Wesley Caudle
Makehna Charlton
Emily Cipriano
Allison Clark
(dual degree in marine science)
Paola Cordero
Tyra Countiss
Kendall Coyle
Jessica Coyne
Alanni Crump
Tyler Cutaia
(dual degree in psychology)
Megan Cyterski
Damian Czaplinski
Kelsey Danford
A'Veon Davis
Alyssia Dilorenzo
Cindy Dinh
Lily Dittmar
Avery Drouin
Hannah Duke
Warren Earley
Samantha Elsey
Erica Evans
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Laurin Fitzgerald
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Zarah Fowler
Hannah Franz
(dual degree in marine science)
Hailey Frick
Aubrey Gaglia
Heather Garrett
Jordan Gertz
Tyler Gesner
Mackenzie Gibbs
Kaylie Grainger
Rachel Greene
Evan Griggs
(dual degree in marine science)
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Taylor Hackett
Peyton Hartenstein
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Samantha Helmenstine
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Katelyn Hryc
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Amber Ketcham
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Stephen Kirkwood
Kylie Kusnarowis
Bailey Lewis
Ilyssa Liberto
Maya Linton-Klatt
Taryn Long
Antwine Loper
Sydney Lutz
Kyla Manning
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Megan Maples
Rachel Mazzeo
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Caleb McClellan
Brianna McCray
Elizabeth McCrea
Kameron McCrea
Sarah McDowell
Dequante McElveen
Dandria McFadden
Justin McNabb
William McNeill
Maya Meenan
Kimberly Mena
Lillian Meyer
Kyle Miles
Veronica Mohr
Marteena Morgan-McNeil
Avy Muon
Nicole Navan
Michelle Ness
Lieu Nguyen
James Olinde
Makenzie Osgood
Corinne Parker
Ajay Patel
Lorela Pengu
Kaylee Persson
Kaylee Petraccione
(dual degree in public health)
Jaiden Phelps
Samantha Porter
Shannon Prather
Morgan Prentice
Tiffany Quinton
Cole Riggins
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Dean Robertson
Ava Robinson
Kaitlyn Sanderson
Joshua Sauer
Lynnae Shultz
Alyssa Simpson
Kassidy Smith
Alexis Stovall
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Madelyn Strick
Elizabeth Taylor
Chloe Thomas
Ryan Thomas
Tien Tran
(dual degree in marine science)
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(dual degree in mathematics)
Lauren Turner
Caitlin Tusman
Jeremy Vugteveen
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Connor Walsh
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Olivia Weeks
Caitlyn Weinstein
Hannah Wenrich
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Marena Willeford
Luke Williams
Jennifer Wiley
(dual degree in marine science)
Jenna Winterberg
Alyssa Woolverton
Deor Zohar

CHEMISTRY

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Tanner Brink
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Caitlyn Evans
Kaitlyn Hunt
Hannah Tierney

COMPUTER SCIENCE

Lester Acosta
Zachary Baker
Patrick Boronski
Jarod Bowers
Steven Burnham
Jason Carranza
Henry Chen
Gianna Conway
Jakari Davis
Clark Dotson
David Foy
Kim Garcia-Morales
Joseph Garrett
Ahmad Geter
Ian Graham
Jorden Hodges
Bailey Johnson
Timothy Kelly
Anakin Kinsey
Nalani Lambright
Anthony Lomax
Ashley Madison
Kelby Martin
Kristin Painter
Brandon Pardue
Jared Pellegrino
Nicklaus Przybylski
James Rashid
Daler Raxmatjonov
Elyssa Sexton
Braeden Slade
Bradley Stemmle
Cheng Sun
Brian Taylor
Baihe Tian
Gabriel Trezza
Joshua Walton
Dkari Worthy

ENGINEERING SCIENCE

Tamer Abu Safieh
Kevin Blinn
Raelee Brabham
Savannah Burdette
Quandre Butler
Dustin Chambers
Alix Chapman
Carissa Church
Lyjah Degrood
Alec Devlin
Joseph Gibbons
Heidrun Hlynsdottir
Chloe Keller
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Sean Malloy
Kyle Montgomery
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Matthew O'Rourke
Jaquan Reed
Marshall Shumpert
Victoria Slifka
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Jacob Teramo
Ian Tokofsky
Timothy Wayman
John Whitehead
Michael Wingo
Jack Yanders

EXERCISE AND SPORT SCIENCE

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Morgan Aldrich
Claire Alverson
Nathen Andrews
Austin Arakelian
John Astudillo
Veronica August
Dakota Barnes
Jordyn Beam
Ebony Beasley
Mya Bess
Cayla Brewer
Jamie Buie
Elizabeth Buzzell
Madeline Campbell
Christopher Cannon
Kinsey Cannon
Cassandra Carley
Morgan Carr
Cade Carter
McKinley Chapman
Linda Clark
Trevor Coleman
Christina Coley
Piper Cote
Samuel Couture
Chandler Crews
Anthony Critelli
Bryn Daly
Iyanla De Jesus
Raegan Dixon
Denise Erskine
Jaibrion Favorite
Megan Finn
Taylor Fiorentino
Natalie Flowers
Madison Forren
Justin Fowlkes
Joshua Garrett
Macey Gathers
Madison Gettings
Nicole Gibson
Megan Gigliotti
Victoria Glaspell
Nicholas Gossett
Aaron Gotses
Kathleen Greer
Thomas Grossetti
Whitney Hager
Kieran Hagerty
Chad Haller
Mallory Henninger
Terrance Heyward
Jeffrey Hodge
Kurstin Hopkins
Sophie Hughes
Austin Jackson
Brandon Jackson
Caroline Johnston
Kaylee Kaczvinsky
Aaron Keeler
Kody Kimball
Randolph Koches
Antonio La Gamba
Jessica Lange
Alyssa Laubenthal
Jessica Lavertu
Michaela Lawlor
Gavin Lewis
Amelia Limon
Angelica Linsmeier
Aidan Looney
Kaylee Lorenzetti
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Margaret Lynch
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Mackenzie Manning
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Jake Marine
Morgan Marlow
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Hannah McCallister
Joella Miller
Dominique Mills
William Moore
Camryn Morgan
Aaron Nance
Tatyana Nesmith
James Nettles
Alyssia Nix
Abagail Nixon
Luke Norris
Mary O'Connor
Courtney Olson
Elizabeth Otto
Noah Page
Carter Parlow
Samantha Parnell
Tariney Pepper
Jayden Perry
Steffany Pershey
Jordan Porchea
Cyas President
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Stephen Shrewsbury
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Tiana Stone
Erica Stratten
Jody Streater
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Gabriella Velleggia
Reina Vierra
Hannah Walker
Destiny Wallace
Nicole Wallin
Tyler Washington
Karley Watts
Damareeay White
Hunter White
Olivia Wiley
Justin Wilson
Bailee Wise
Myka Wydo
Anna Yarborough
Morganne Young

HEALTH ADMINISTRATION

Lauren Brown
Kimberly Gordon-Whitfield
Tianeshia Heath
Michael Henry
Georgia Johnson
Wesley Sampson
Chrystal Spivey
Alicia Thompson
Asia White
Keynovia Williams

INFORMATION SYSTEMS

Christopher Brady
Jack Bresnahan
Joshua Edwards
Ryan Focht
Kellen French
Alexander Heiberg
Reuben Hestad
Mattie Mahoney
Taylor Malamut
Tyler Shobe
William Sloop
Ryan Wethey
Anthony Zincone

INFORMATION TECHNOLOGY

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Lateisha Austin
Nicholas Bonn
James Bozeman
Johnathan Cassidy
Lauren Denning
Vanquacious Dennis
Nysheim Dewitt
Bryan Dilone
Rhiannon Dore
Jason Dupree
Jennifer Gregg
Trevar Hall
Devin Hyatt
James Kesler
Brandon Lackey
Nicholas Lawson
Breonia Lee
Riley Lutrario
(dual degree in sociology)
Walter Moore
Ryan Moss
Christina Nance
Liam Nelms
Dillon Paton
Ginger Pettit
Tyrell Ross
Kenneth Skipper
Cornelius Smith
DiMitri Smith
Marcus Starr
Savon Stokes
Anthony Thompson
Allen Watson
David Welsh
Brandon Wrenn
Dominique Young

MARINE SCIENCE

Sarah Abel
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Samantha Alderman
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Lauren Andrychowski
Erica Baba
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Nevaeh Bennett
Ariana Birchler
Jonathan Blackwell
Adriana Bohon
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Christian Boudreau
Brianna Bradley
Kristen Bradshaw
Logan Breidenstein
Noelle Briggs
Mitchell Brooks
Rachel Broumas
Jordan Browning
Madison Bruno
Devin Bucci
Megan Bullock
Alexis Burch
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Allison Cahill
Vanessa Calling
Bridget Campbell
Brandie Cantrell
Kaylie Card
Jacquilynn Chao
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Shannon Combs
Alyssa Conway
Allison Correa
Lindsay Cowen
Kaylie Crawford
Julia Crews
Conner Crosby
Evan Curcio
Sydney Davis
Autumn Dellorso
Morgan DeMayo
Jasmine Dessert
Taylor Dishon
Tabatha Doetsch
Kayla Doucette
Ashton Dunnigan
Sarah Dziekowicz
Carissa Emory
Reagan Eppes
Gregory Fackler
Kaitlyn Frack
Alexis Franklin
Hannah Franz
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Stefanie Fridkin
Madeline Fudala
Sunnidae Gallien
Isabelle Gautschi
Abigail George
Brieanna Gillen
Bryn Gliebe
Anne Gossman
Nicholas Govostes
Robert Grecu
Evan Griggs
(dual degree in biology)
Gabrielle Grobbel
Alexis Gue
Bailey Hall
Daniel Hannon
Jordan Harrison
Peyton Hartenstein
(dual degree in biology)
Anna Hartman
Xavier Hawpe
Michael Hendrix
Katherine Herrell
Hannah Hicks
Niva Hoffman
Phoenix Holmes
Amber Holshouser
Fiona Hughes
Julia Illar
Lynsey Isner

Nicholas Jackson
Brooklyn Johnson
Kyle Jolls
Janina Jones
Heather Juhlin
(dual degree in biology)
Chloe Keller
(dual degree in engineering science)
Preston Kelly
Allison Kladler
Seth Koepfler
Allison Kreyer
Amber Kuck
Jainah Kynard
Meredith LaLumia
Aliyah Lambert
Amanda Lane
Annika LaRoche
Reagan Lawery
Alyssa LeClaire
Christina Lefebvre
Olivia Lentchner
Kaylin Leroy
Faith Liddicoat
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Emily Lindell
Lydia Lopez
Yasmine Lopez-Vargas
Skyler Lorick
Alexis Lowe
Casey Ludwick
Brady Ann Lynch
Zoe Lyons
Sydney Madden
Alyssa Manuel
Ayana Maryott
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Casey Mazzone
Matthew McCauley
Sidney McCoy
Hannah McCutcheon
Nicole McHugh
Tiffani McNeil
Diana Menendez Cebreros
Cameron Mewhirter
Haileigh Miller
Laura Miller
Charles Mina
Jessica Moeller
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Jonathan Moore
Nora Mouer
Meghan Music
Bethany Newton
Michaela Nichols
Britney Nicholson
Landon Oakes
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Hogan O'Brien
Kirstin O'Donnell
Hailey Oldfield
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Matthew Oswald
Shawn Passeri
Kyrstin Pedrick
Margaret Pepin
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Danielle Perkins
London Perry-Tatem
McKenna Poenitske
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Kennedy Quillen
Timothy Rafala
Zachary Ramsey
Nikolas Rassenfoss
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Logan Rice
Grace Richa
Cole Riggins
(dual degree in biology)
Wesley Ritenour
Eryn Roach
Madison Robison
Adrian Rodden
Cheyanne Rufener
Jade Salis
Jessica Sanders
Russell Scherr
Mackenzie Scheuermann
Lexie Schon
Ashley Schwenck
Jessica Shoemaker
Madison Sieminski
Wyatt Slatter
Victoria Slifka
(dual degree in engineering science)
Abigail Smith
Zachary Smith
Sarah Sowell
Megan Speer
James Spirek
Madilyn Stanton
Kailey Stillman
Alexis Stovall
(dual degree in biology)
Miles Tarullo
Daphne Terris
Natasha Terry
Sarah Thornton
Walker Todd
Tien Tran
(dual degree in biology)
Arianna Trapp
Drew Turner
Rachel Uebelacker
Nicholas Urbanek
Aireal Vickers
Jeremy Vugteveen
(dual degree in biology)
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Christopher Walker
Kayla Washington
Haley Wells
Cassady Whaley
Amber Whibley
(dual degree in psychology)
Joie Wicher
Jennifer Wiley
(dual degree in biology)
Colten Winter
Dean Wrobel
Lia Zazzera
Katelyn Zimmerman
Patricia Zwolinski
Julie Zylich

MATHEMATICS

Jathan Bellemare
Meghan Birchfield
Gemal Jackson
Jason Kemble
James Mabry
Michael McFarlane
Jessica Solomon
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(dual degree in biology)
Renea Urbaniak
Adam Vincent
(dual degree in physics)

NURSING

Elizabeth Caine
Cristin Cox
Jannine Saia

PHYSICS

Maoling Chu
Brandon Holladay
Kove Lambert
Shawn Maier
Michael Melchiorre
Cole Munger
Andre Newbauer
Benjamin Pfingstler
Zachary Stevens
Adam Vincent
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Cameron Watkins
Benjamin Wellons

PSYCHOLOGY

Matthew Abajian
Elizabeth Armstrong
Neelie Bailey
Brachus Baldridge
Kareem Barbis
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Samantha Bossany
Perris Bowling
Adam Bretton
Dawn Brewer
Ariyonia Busby
Alexandra Buxbaum
Taylor Byers
Brooke Caffrey
Elisabeth Chambers
Hannah Cherewko
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Emily Cruse
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Gianna D'Aconti
Nikoli Daigneault
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Carlie Dingle
Thomas Dombrowski
Natalie Dougherty
Ashante Edwards
Madison Fecteau
Jacquelyn Fennell
Faith Finan
Shakera Fuller
Gianna Gaetano
Lois Garlow
Alexandra Glinka
Jaclyn Graveline
Caroline Gray
Myance Green
Bridget Greenhalgh
Madison Gregory
Lexcie Harper
Maggie Hennessy
Meghan Hepner
Cassandra Herberger
Bethany Hewitt
Sonya Holmes
Hanna Hopkins
Lauren Hribar
Julia Humphrey
Angela Hurd
Haley Incarnato
Sarah Johnson
Delaney Johnston
Rachel Kaeser
Adam Karaskevicus
Colin Katchmar
Kira Koon
Julia Krantz
Kayla Ladson-Bailey
Alexandra Laird
Brynn Leiphart
Caitlyn Lewis
McKenzie Lucas
Ashley Machado
Madison Magnus
Nyla Manley
Hailey Marrero
Alyssa Martin
Alexandria Mays
(dual degree in management)
Hanna McClure
Skylar McCummings
Nicole McDonald
Troy Mcie
Tessa Meadows
Haley Molloy
Jaylyn Moore
Carleigh Morgan
Kayla Nagle
Kayla Neidermyer
McKenzie Nichol
Savannah Nixon
Jonah Nordeen
(dual degree in biochemistry)
Cameron O'Connell
Kayley Ozimac
Hollie Paquette
Sarah Parker
Fiona Paul
Freddie Pearson
Jerardo Perez
Johnathan Perez
Raechel Peterson
Katlyn Picataggio
Sarah Poisson
Ashlyn Poling
Tiandra Reed
Jazmine Reyes
Martin Rydningen
Natalie Seibel
Kaitlin Serad
Savannah Sharpe
Alyssa Shenk
Hayley Sheriff
Melina Shildt
Jada Sims
Garrett Small
Megan Smith
Anna Snyder
Alexis Starr
Jaliya Toomer
Kayleigh Travins
Krystine Treece
Robert Tucker
Kaleigh Tunnell
Jennifer Vasquez
Sandra Walder
Victoria Walters
Jessica Warzel
Nikkole Wheeler
Amber Whibley
(dual degree in marine science)
Cecilia White
Amanda Williams
Devon Williams
Stacey Wolf
Elisabeth Wood
(dual degree in public health)
Kamryn Zanella

PUBLIC HEALTH

Matthew Abajian
Taleaa Adams
Mikaela Alt
Brae-Elise Ayers
Shelley Baker
Kayla Ballo
Sydney Barbour
Emily Bates
Alexis Biernacki
Alexis Bothe
Michelle Boyette
Jahnae Brown
Abigail Buchanan
Josanna Butler
Michelle Cabrera-Santana
(dual degree in languages and intercultural studies)
Rylee Chandler
Jordan Cockrell
Lauren Conners
Isabel Debari
Joseph Eckenrode
Britney Estridge
Jeremy Evans
Emily Gerding
Lauren Gibson
Kirsten Good
Amy Gordon
Haley Green
Julia Hagerud
Jessica Hinton
Abigail Hopper
Dylan James
Darnasia Jenkins
Jenjira Jinangkul
Wesley Johnson
Zi'Kieeya Johnson
Brayleigh Jones
Reiley Jones
Mikayla Kegel
Allison Kint
Alyssa Klaess
Sarah Lauer
Jordyn Lord
Summer Malinowski
Russel Mapula
Heaven Mazyck
Miranda McLaughlin
Meagan Modrusic
Nasser Mohammad
Alyce Moore
Camden Murphy
Amanda O'Donnell
Erin Palmer
Savannah Patinka
Kaylee Petraccione
(dual degree in biology)
Audra Phillips
Courtney Recher
Naomi Reed
Hailey Restuccia
Kaitlyn Romanowski
Jada Salley
Carson Sanders
Kayla Sanders
Katelin Sellers
Maddelena Silvestri
Elizabeth Skipper
Damari Smith-Lockett
Veronica Spates
Brooke Spence
Jenna Stash
Sophie Sumpter
Carolyn Ta

Tessa Taylor
Susan Walker
Lauren Watkins
Anyjhia Wilkins
Grace Williams
Hassani Wilson
Elisabeth Wood
(dual degree in psychology)
Kilee Yager

RECREATION AND SPORT MANAGEMENT

Michael Agens
Justin Alleyne
Ronald Anderson
Sean Aubry
Sierra Baxter
Alliyah Beisell
Jackson Bell
Nicholas Benson
Lee Blakeney
Flynn Bourgault
Cedric Brown
Josh Calhoun
Jordan Carnes
Thomas Chepurko
Keera Clarke
Ally Clegg
Emily Cottrill
Olivia Crum
Nikolaus Czarnota
Jackson D'Angelo
Charles Daniels
Jalen Darby
Brandon Darrigo
Madeline Davis
Mason Defilippis
Daydrion Dereef
Jordan Donald
Indeveer Dulku
Lauren Dzierski
Dallas Earnhardt
Travis Elseroad
Conrad Felks
Andrew Ferreira
James Gordon
Brett Grove
Sydney Guess
Max Haberman
Rachel Hamilton
Kimoni Harris
Connor Havrisko
Jason Heon
Dylan Hoffman
Jack Hudson
Morgan Hyde
Morgan Jackson
Chelsea Jameson
Caleb Jatcko
Blake Johnson
Bryan Johnson
Olivia Kelleher
Alexander Kennedy
Evan Kerecz
Haley Kerwin
Derek Kidd
Katherine Kilroy
Samuel Kyzer
James Largen
Alexander LeMoine
Gregory Liverpool
Maxwell Lowson
Bryce McLaughlin
Joseph Morrell
Alexander Mottola
Marissa Munson
Kyle Nachtsheim
Kamryn Nobles
Thomas Norris
Taylor Novotny
Michael Olshefski
Bernard Palmer
Brigitta Petrenko
Matthew Prokop
Jason Randall
Alexa Reginatto
Dylan Reyes
Sean Rhodes
Amanda Richardson
Bradley Riopelle
Alexander Roberts
Samuel Rowell
Justin Scola
Timothy Sexton
Teana Sherman
Anthony Smalls
Demarious Smith
Ryan Strobel
Tanner Sulich
Morgan Sutton
Zachary Tatarka
Kaylie Taylor
Cameron Thomas
Triston Thomas
Adlai Traver
Daniel Vance
Harris Varnum
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William Young
Thomas Zinngrebe

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Emily Ayala
Rebekah Booth
Courtney Brown
Carrington Cain
Connor Cartmell
Paige Cenicola
Tabyus Conley
Kristyn Cromer
Jocelyn Crum
Callan Curry
Carolynn Dallas
Kasmin Dorsey
Keondre Fields
Cara Fisher
Jasmine Ford
Shannon Foy
Ronyaih Frierson
Lamonica Grissett
Kristen Guccione
Emily Hampton
MaClaley Hardee
LaKayla Hibbitt
Shelby Hosack
Perrin Hubbard
Eve Ivey
Tara Kellogg
Jonathan Kerr
Dajah King
Jackson Little
Michael Loyd
Nicholas Lucky
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Quajenee Melton
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Azunna Njoku
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Ryan Smith
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Samantha Torsiello
Daniel Turner
Jasmine Vasquez
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Ansha Wilds
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UNDECLARED SCIENCE

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